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THE FOUNDRY

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1933

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Representative examples of cores blown within the past few months are illustrated on the next page. Examine these carefully. To actually SEE and FEEL these cores would CONVINCE you that Osborn Core Blowing Machines merit your consideration.

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The view at the left illustrates the Osborn No. 92 Core Blowing and No. 36 Core Box Drawing Machines teamed up for continuous high-speed, high-quality, low-cost core production.

OSBORN

THE FOUNDRY for July

Counting the SCORE

EVERYONE participating in the American Foundrymen's association week in Chicago last month sensed the quickening impulse given the industry. Technical advance profited largely through the meetings and the dissemination of information in roundtables and in committee sessions. The show, though limited in scope was interesting and splendidly presented. It excelled in the number and character of new machines and materials introduced. Foundrymen evidenced the need for equipment and supplies through inquiries and purchases. The influence of the A. F. A. in related industry affairs was demonstrated by the gray iron symposium at the American Society for Testing Materials meeting and at a special session of the American Society of Mechanical Engineers the week following. Further, an important contribution to the welfare of castings manufacturers was made through special meetings of the various branches of the industry where action was crystallized to meet the government's call under the National Industrial Recovery act. Well done, A. F. A.

Swing into ACTION

THAT trait of human nature typified in the childhood rhyme by the admonition, "Tarry a while, says Slow" seems absent in the foundry industry. The regimentation of the entire industry under groups representing the steel, malleable, gray iron and nonferrous interests is swinging ahead. Competent committees truly representative and authorized to offer full co-operation under the National Industrial Recovery act are driving hard and soon codes will be formulated and presented to the administrator for his approval. Co-operation through a central executive committee from these four main groups will act to reconcile internal differences and to adjust the group codes to the common good of the entire industry. Such a co-ordinating committee should be established promptly. It will prove a valuable agency in forwarding the programs of those groups which still have organization problems. In an impartial and purely advisory capacity its services are badly needed. The perplexities of the manufacturer seeking proper affiliation when more than one class of castings is produced in his plant and the machinery builder with foundry departments of varied character await a solution which such a committee could supply. Further, those cross currents of dissenting opinion or the attempted volunteer leadership based upon only one phase of the complex NIRA require informed consideration, that the best interests of the entire foundry industry may be served. A co-ordinating board small enough to be effective, large enough to be representative, strong enough to win respect, impartial and trustworthy in personnel is the definite need of the day. Although designated, perhaps, by the trade associations of the various groups or by the central committees of the branches, the men chosen for the job at hand should sink the individual interests of their respective lines of manufacture and become in every sense partisans of the entire foundry industry. Such men are available. They should be chosen and set to work at once on the broad phases of the problem.

What's New IN JULY

DEFINITE and marked improvement in the foundry business reported at gatherings in Chicago during the A. F. A. (page 18). New machines, new methods and materials demonstrated to visitors (page 22). Gray iron castings of jewel like size and delicacy (page 25). Woman metallurgist expounds wear resistance of malleable iron (page 28). Titanium as an alloying agent in gray iron (page 32). Just the gist of projected advance (page 37). The bridegroom gets a break—at last (page 56).

Left to Right—Robert E. Kennedy, Dan M. Avey, Frank J. Lanahan and C. E. Hoyt

Convention Leads Recovery Parade

Optimism prevails as foundrymen gather to discuss technical and business problems

MEASURED from the standpoint of optimism for a continued and rapid improvement in foundry business and for the future development of castings to meet the ever increasing demands in satisfying the needs of modern civilization, the 1933 convention of the American Foundrymen's association held in Chicago the week of June 20 far surpased any previous annual gathering in recent years. Foundrymen from all parts of the country carried with them to the convention reports of marked increases in operations of all types of foundries thus permeating the entire meeting with a spirit of confidence.

Attendance Exceeds Expectations

Attendance exceeded expectations of those in charge of that important activity in the development of the industry. Each technical session attracted unusual crowds and in numerous instances meeting rooms were taxed to capacity to handle the large number of operating foundrymen and technical men who came to take part in the various discussions. The technical program provided a splendid collection of valuable papers pointing to gratifying progress in the solution of production problems and the introduction of processes and products which will be of vital benefit to the industry in furthering the sale of cast products. Animated discussion with an exchange of experiences followed the majority of papers.

Interest in the provisions in the National Industrial Recovery act drew many visitors to the convention to attend one of the four conferences held by the gray iron, steel, malleable and nonferrous divisions of the industry and also the Foundry Equipment Manufacturers association. Reports of activities in that direction are presented on page 24 of this issue.

Important activities of the association during the past year were discussed briefly by President T. S. Hammond at the opening meeting of the convention on Tuesday morning. These include the *Handbook on Cast Metals*, which now is being prepared under the auspices of the A. F. A., and the work in connection with good housekeeping in foundries. President Hammond believes that the important activity of the immediate future is to find where the foundry industry will fit into the situation created by the

Col. Baker of the Steel Founders Society looks on while T. H. Harvey, president of that group, speaks

National Industrial Recovery act. Vice President Frank J. Lanahan also stressed the importance of that legislation to the foundry field.

Announcements regarding important features of the convention program were presented by C. E. Hoyt, executive secretary and Robert E. Kennedy, technical secretary. Dan M. Avey, chairman of the international relations committee of the association presented a resolution embodying greetings to the Institute of British Foundrymen, which was holding its meeting at the same time in London.

Stage Set for Recovery

Underconsumption of the products of industry during the past four years has set the stage for an immediate and reasonable business recovery, in spite of all legislation passed by the recent congress, declared Fred W. Sargent, president, Chicago & North Western railway, Chicago, speaking before the joint luncheon meeting of the A. F. A. and the Foundry Equipment Manufacturers' association on Tuesday. As an example of the potential demand now existing for materials, Mr. Sargent stated that the railroads do not have enough material of certain types on hand to last a week if business improves to any great extent.

Combined legislation of the last congress delegating legislative authority to the executive branch of the government and moving entirely out of the laissez-faire doctrine into that of a socialistic, co-operative and co-partnership arrangement between government and all its various individual and corporate lines of activity may be considered as one of the three great turning points in American history, according to Mr. Sargent. The others were the American revolution with the adoption of the constitution, and the establishment of the permanency of the Union.

If such a policy can be administered without destroying the incentive to progress, without destroying individual initiative and enterprise, then such a policy is to be desired. However, Mr. Sargent believes the great fear is that human nature may have to be made over before a socialistic regime will succeed. He expressed the hope that the American nation in administering the new laws, will keep as close as possible to those sound, fundamental rules of government and economic principles that have guided us in the past and at the same time undertake, through the recent legislation, to bring about even a greater era of prosperity and a greater distribution of wealth than we have experienced in the past.

To this end, Mr. Sargent stressed the necessity for every man and woman aiding the administrating of the new legislation. We must live, however, always in the hope that we will not abandon completely the basic principles of a free and democratic form of government that already has stood the test for a longer period than any other similar government in all history.

The annual business meeting of the association was held Thursday afternoon with Vice President Frank J. Lanahan presiding in the absence of President T. S. Hammond. C. E. Hoyt, executive secretary reported briefly on the affairs of the association and Robert E. Kennedy outlined the most important of the technical activities of the past year. Features stressed included work on the *Handbook on Cast Metals* which rapidly is nearing completion, and the co-operative efforts of the A. F. A. and other technical associations in making available through papers and lectures, information on cast products of interest and value to the field of engineering.

Technical sessions and meetings on the Industrial Recovery Act both drew large crowds

Chairman Dan M. Avey, presented a report of the international relations committee and read telegrams of felicitations from the Institute of British Foundrymen and the French Technical association. The committee has plans under way for making the fifth international foundry congress, which is to be held in the United States, the most important affair of that kind yet held.

A new custom was introduced by the board of directors providing for the election of four members of the 1934 nominating committee at the annual business meeting instead of by letter ballot as previously was the procedure. P. T. Bancroft, John Deere Harvester Works, East Moline, Ill., chairman of a committee appointed by President Hammond at the opening meeting to select candidates, placed in nomination W. C. Hamilton, American Steel Foundries, Chicago; E. E. Griest, Chicago Railway Equipment Co., Chicago; A. S. Boegehold, General Motors Research Laboratory, Detroit; and E. F. Hess, Ohio Injector Co., Wadsworth, O., who were duly elected.

C. E. Hoyt, presented the report of the 1933 nominating committee, which was accepted and the following were declared elected: President, Frank J. Lanahan, Fort Pitt Malleable Iron Co., Pittsburgh; vice president, Dan M. Avey, THE FOUNDRY, Cleveland; directors for 3 year term, George Batty, Steel Castings Development bureau, Narberth, Pa.; T. S. Hammond, Whiting Corp., Harvey, Ill., R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, and J. L. Wick Jr., Falcon Bronze Co., Youngstown, O.; Director for 1 year, Dr. H. Ries, Cornell university, Ithaca, N. Y. Retiring president T. S. Hammond unanimously was elected an honorary member of the A. F. A.

E. H. Ballard, General Electric Co., West Lynn, past president of the association, following a fitting tribute, presented the Joseph S. Seaman gold medal to Guilliam H. Clamer, president and general manager, Ajax Metal Co., Philadelphia, Ajax Electric Furnace Co., Philadelphia, Ajax Electrothermic Corp., Trenton, N. J., and the Ajax Electric Co., for his valuable contributions to the foundry and especially the field of nonferrous metallurgy.

Foundrymen Take the Stage

"Building for Profits," a four-act play, effectively dramatized the benefits of an efficient cost system before a large audience at one of Tuesday's sessions. The cast of 16 actors, headed by James L. Wick Jr., Falcon Bronze Co., Youngstown, and Albert E. Grover, cost director, Gray Iron institute, Cleveland, portrayed the experiences of the "Monarch Foundry Co." in attempting to eliminate losses which gradually were pushing the company into bankruptcy. Over the objections of some of its directors a cost expert was engaged to make a survey of the company, recommendations for the installation of a new cost system were adopted and losses were turned into profits. Proper methods of figuring costs on proposed casting work were detailed during the play.

Representatives of industry and educational institutions teaching foundry practice met in conference Friday afternoon to discuss common problems pertaining to furthering the interests of the foundry industry. President elect, Frank J. Lanahan was chairman, and Frank G. Steinebach, managing editor, THE FOUNDRY, Cleveland was vice chairman. Dean C. J. Freund, Detroit university, Detroit, opened the discussion with the statement that educational institutions today need the same type of co-ordination with industry that industry now maintains with its trade and technical associations. He feels that the task of maintaining these contacts rests largely with the educators.

B. H. Johnson, R. D. Wood & Co., Philadelphia, stressed the lack of demand for college trained men in industry. R. E. Kennedy, pointed to the fact that probably the greatest task of those in charge of courses in foundry practice is to train men in the value of cast products as engineering materials. Carl Casberg, University of Illinois, Urbana, Ill., took issue with the previous statement regarding responsibility for contacts, and feels that industry must endeavor to establish contacts with the college and university faculties.

The splendid service which many colleges and universities are providing industry was stressed by W. D. Moore, American Cast Iron Pipe Co., Birmingham, Ala., in a statement that the pipe industry could not have reached the high position it now occupies without the co-operation which has been given. His firm makes a definite practice of taking a certain number of college graduates each year, and after a period of training in the various phases of foundry practice, some have returned to the colleges as instructors. Later, some again have returned to his company, thus cementing the bond of interest between the two types of organizations. Mr. Moore proposed that the plan of having students visit representative foundries be enlarged.

Prof. A. E. Wells, Cornell university, Ithaca, N. Y., believes that the plan of providing work in foundries for students during the vacation periods between the second and third and the third and fourth years will aid materially in creating an interest in the industry and its product among engineering graduates. Prof. J. M. Dorrans, University of Wisconsin, Madison, Wis., feels that industry will be lax in seeking co-operation of the university, and therefore, the institution of higher learning must attack the problem from the standpoint of the present.

From left to right: G. H. Clamer, 1933 medalist, Frank J. Lanahan, the new president, and Major Bull, 1927 medalist. Both Mr. Clamer and Mr. Bull are past presidents

R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., deplored the lack of selling as related to cast metals and described the educational work that has been carried on by the Malleable Iron Research institute during the past year in supplying a vast amount of information on malleable iron to schools and colleges. R. E. Wendt, Purdue university, Lafayette, Ind., mentioned the extra credit courses which that institution is providing for engineers wishing to specialize in foundry practice, and also described a motion pic- (*Please turn to page* 46)

Interesting exhibits were on display in the Exhibition Hall

Foundrymen See Developments

A. F. A. Exhibition at Chicago replete with new and improved machines and supplies

DEVELOPMENTS in foundry equipment and supplies during the past 2 years should provide a good foundation upon which to meet production problems in the period which lies immediately ahead. Interesting products in the way of machines and materials, all included in the classification of foundry equipment and supplies, were shown for the first time in many instances, at the foundry and industrial exposition held in the exhibition hall of the Stevens hotel, Chicago June 20 to 23, in connection with the annual convention and technical meeting of the American Foundrymen's association.

Show Exceeded Previous Efforts

From the standpoint of innovations and refinements and improvements in products which previously have given excellent service to the industry, the 1933 show far exceeded previous limited exhibitions staged in the same location. The display included two new types of core blowing machines, a core blowing machine which has been greatly improved in design, several new types of molding machines and numerous changes in molding machine design, a new blast cleaning unit utilizing a device which throws the abrasive against the castings by centrifugal action, several new types of dust arrester and collecting equipment, a machine for separating and cleaning the blast abrasive, a new type of material for making matchplates, new core oils, and a wide variety of other developments covering the field of both foundry equipment and supplies.

Optimism Everywhere Apparent

Considerable interest in the newer types of equipment was noted on the part of visiting foundrymen, and several purchased new equipment or modernizing parts and assemblies during the week. The optimism displayed by the visiting foundrymen also was apparent among the exhibitors, and many anticipate continued improvement in foundry equipment demand as the year progresses.

New developments in equipment for cleaning castings provided an interesting feature of the show. The American Foundry Equipment Co., Mishawaka, Ind., operated a continuous type cleaning unit equipped with its latest development, a device for throwing the abrasive against the casting by the centrifugal process. The company also exhibited a new tubular type dust arrestor.

W. W. Sly Mfg. Co., Cleveland, operated a new abrasive separator designed to give three distinct separations, including the return of

clean abrasive to the pressure blast tank. The separation is accomplished by an air wash and the equipment is adjustable to a wide variety of conditions. The unit is equipped with a new elevator device and is driven with V-belts. The company also operated a flat bag dust filter, and showed a blast helmet equipped with an automatic pressure regulator and filter for cleaning the compressed air, long life nozzles and an exhibit of shot and grit metal abrasives.

Macleod Co., Cincinnati, showed a blast pressure tank, an oil burner for lighting cupolas and drying ladles, a blacking spray and a small torch for skin drying molds. The company also exhibited a series of photographs showing sandblast tables, cabinets, tumbling type blast units, and dust arrestors. Pangborn Corp., Hagerstown, Md., exhibited a new bag type dust arrestor unit which was provided with glass ends to permit observation of the operating mechanism. The company also displayed several of the individual new screen sections, two new air ventilated helmets with air purifying and washing equipment, new long-life nozzles, steel abrasives, sandblast hose and accessories. Carborundum Co., Niagara Falls, N. Y., provided a beautifully colored display showing a variety of grinding wheels applicable to foundry work.

Practically every class of equipment for the foundry was represented with attractive displays

and featuring a pile of raw carborundum in the center of the display.

Interest displayed in recent years in the use of compressed air for blowing sand into coreboxes is illustrated by the fact that three companies exhibited machines for that work. A new type of core blowing machine was operated by the Osborn Mfg. Co., Cleveland. An auxiliary machine for removing the corebox from the finished core was shown in addition. It is claimed the blowing machine also may be employed for filling flasks with molding sand. The machine is under automatic mechanical control and this feature removes the hazard incident to the human element on the part of the operator. A small compressor in the same booth furnished the air for the machine. This compang also exhibited a new type of jolt squeeze machine in which the squeezing head is attached to the upright main post and may be swung out of the operator's way when setting a flask in place on the table or while removing the rammed mold.

Among the many changes and improvements in the machine shown by Wm. Demmler & Bros., Kewanee,, Ill., is the use of a crank handle on one side for operating the corebox table. An automatic air valve controls the movement of the sand hopper. A single (*Please turn to page* 66)

New developments and improvements in machi nes and supplies provided a feature of the show

Plan Organizations and Codes

Groups take action to meet requirements of government under industrial recovery act

BENEFITTING from the occasion offered by the convention of the American Foundrymen's association held in Chicago during the week of June 19, the various elements composing the foundry industry took action to meet the requirements of the government under the industrial control act. In assisting to stimulate interest in this matter, the American Foundrymen's association extended full co-operation, acting with the various trade association groups in arranging industry meetings. To these all identified in any way with the foundry industry, whether or not affiliated with the trade associations, were invited.

The first meeting of a series of four was held Tuesday, June 20, when the Foundry Equipment Manufacturers' association presented for discussion a plan of organization and suggested code of fair competition. The committee which presented this matter consisted of Franklin G. Smith, chairman, Osborn Mfg. Co., Cleveland; S. C. Vessy, W. W. Sly Mfg. Co., Cleveland, and H. C. Hersey, C. O. Bartlett & Snow Co., Cleveland. After discussion by the meeting, the matter again was referred to the same committee with instructions to consider means of effecting an organization.

Discuss Phases of the Act

The Gray Iron institute scheduled a meeting for Wednesday afternoon, June 21. At this meeting attended by more than two hundred foundrymen, various phases of the industrial recovery act were covered. A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., president of the institute presided. Phillip Frankel, attorney, Cleveland, explained the law and its operation and A. J. Tuscany, manager of the institute outlined the measures which have been taken to formulate an organization of the entire gray iron industry.

The plan of organization of the gray iron industry has proceeded through the co-operation of the institute which has provided the local contacts and basic data. Seventeen districts throughout the United States, at individual meetings, elected delegates and alternates. Thirteen of the 17 delegates in session Thursday morning elected a steering committee of five as follows: Walter L. Seelbach, Forest City Foundries Corp., Cleveland; F. A. Hoadly, Farrel-Birmingham Co., Ansonia, Conn.; A. H. Kramer, Advance Foundry Co., Dayton, O.; C. B. McGrath, Greenlee Foundry Co., Chicago; William T. Mellow, Liberty Foundry Co., St. Louis.

This committee was instructed by resolution to proceed in compiling data and statistics and in the formulation of a code of fair competiion meeting all of the requirements of the industrial control act. The steering committee elected to carry on this work through the Gray Iron Institute.

Steel Founders Take Steps

At a meeting of the steel foundry industry held Friday morning, the Steel Founders' Society of America reorganized to meet requirements of the industry control measure. At this general meeting to which all producers of steel castings were invited, T. H. Harvey, Ohio Steel Foundry Co., Lima, O., presided. Col. Merrell G. Baker, executive vice president of the society presented new by-laws changing the form of organization of the Steel Founders' society. These by-laws which were adopted by the society provided for eight geographical divisions. Each division will elect a representative who will become a member of the board of directors of the society. The president is elected from the membership, and the executive vice president and secretary appointed by the directors. An executive committee consisting of the chairman of the board of directors, the president, and the executive vice president is provided.

In discussing the industrial recovery act, Colonel Baker explained that no official act had been taken toward providing a code of fair competition or any other phase of the matter. President Harvey dissolved the meeting of the Steel Founders' society and called to order a coalition meeting of the industry at large, at which F. A. Lorenz Jr., American Steel Foundries, Chicago, was invited to preside. (*Please turn to page* 72)

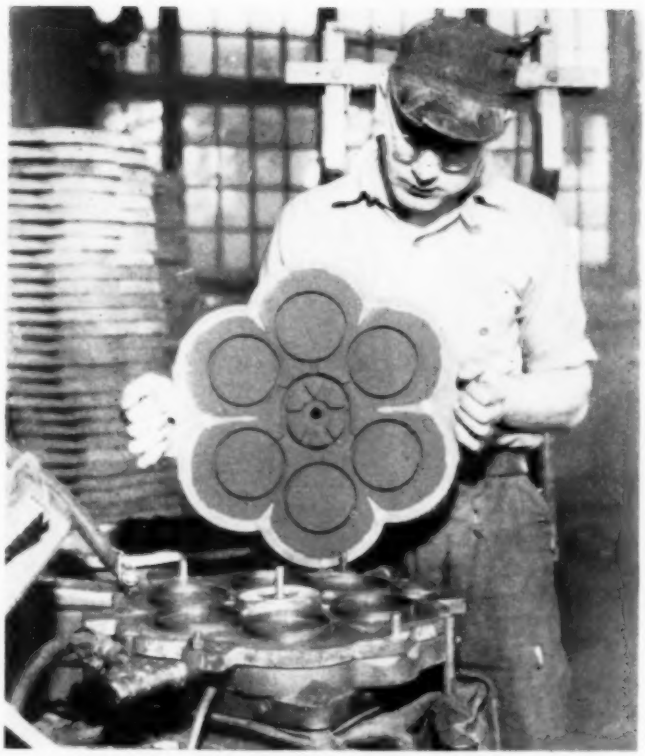


Fig. 1—Specially designed flasks reduced sand requirement to the minimum, and lessen lifting fatigue

Electric Furnace Iron Used for Piston Rings And Valve Tappets

By FRED ERB
and
EDWIN BREMER

DEVELOPMENTS in the metallurgy of gray iron, which have improved its physical properties, and placed it in a strategical position to meet economically many requirements in engineering design and service, have been followed by increasingly rigid requirements from the automotive, refrigerator, glass and other industries for high quality gray iron castings. Hence, it is not only necessary that the modern foundry be able to meet those requirements, but also to keep in advance of the constantly changing conditions.

Therefore, constant research and the installation of modern equipment are essential to meet demands of consumers for highest quality castings concomitant with economical production. In addition the foundry must have facilities available for controlling and reproducing castings with definite physical properties to meet a variety of service requirements day in and day out.

One of the many foundries which has kept abreast of modern times is the Eaton-Erb Foundry Co., Vassar, Mich. This leadership is illustrated by the fact that the firm is a pioneer in the manufacture of electric furnace iron. It operates a production foundry specializing principally in automotive work, making piston rings, valve tappets, valve seat inserts, camshafts, etc., and also is engaged in the production of refrigerator castings, glass molds, and production machine parts. The Eaton-Erb company employs two distinct molding processes, namely the permanent or metal mold process, and the sand mold process.

The former process using mainly cupola metal was described previously in the June issue of THE FOUNDRY, and this article will be devoted to features of the sand casting foundry. In addition to the difference in the mold materials, metal for the sand casting shop is melted in electric furnaces. Two furnaces of the rotating, indirect arc type, manufactured by the Detroit Electric Furnace Co., Detroit, are used for that purpose. One of the furnaces, the first to be installed by the Eaton-Erb company, has a capacity of 6000 pounds while the other, considerably smaller, has a capacity of 400 pounds.

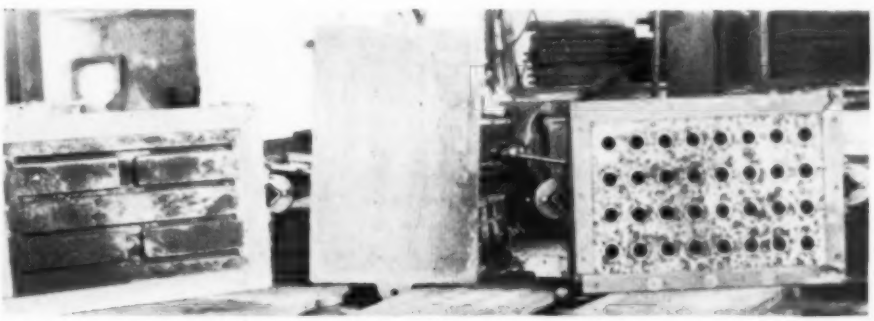


Fig. 2—Cope, drag and cheek for making valve tappets. The chill plate forming the drag has grooves cut in its face

The large furnace is used on production work, and the smaller for development work, special alloy irons, etc.

A feature of the large furnace is that it is mounted upon a scale so that at any time the amount of metal it contains may be determined. However, the weighing feature mainly is used when the furnace is charged so that exact amounts of the various raw materials may be introduced into it. Only the weights of the bulk materials such as pig iron, steel scrap and return scrap are determined on the scale as any alloys added are so small in comparison to the main body of metal that difficulty would be encountered in measuring the quantity on such a coarse weighing device. Consequently, the alloys are weighed on a smaller, more accurate scale.

Feature Important in Duplexing

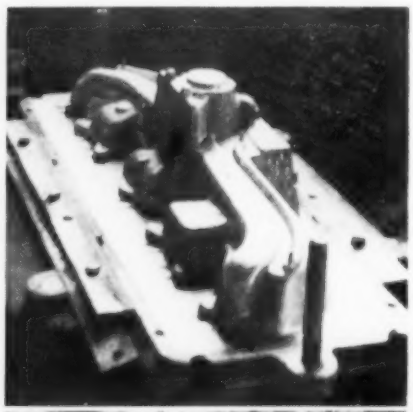
The weighing feature is especially useful when iron is duplexed from a cupola, which is located close to the electric furnace. Through the use of the scale a definite quantity of molten metal of previously determined composition is permitted to run into the electric furnace from the forehearth of the cupola. Then the correct amount of steel scrap is added to reduce the total carbon to the desired point.

One of the developments of Easton-Erb Foundry Co. is a gray iron piston ring made of electric furnace iron. With that type of iron it is claimed that many improvements have been obtained including higher strength, better tension, elimination of hard spots, better machineability and more uniform structure. To give some idea of the results obtained, the following figures taken from the first article of this series which appeared in the April issue of THE FOUNDRY will bear repeating: Load in pounds required to break finished rings, 11.4; stretch in inches, 0.781. An average of 10 tests on 3⅝ x 5/32-inch finished oil control rings required a load of 19.1 pounds to break, and the stretch was 1.472 inches.

Piston rings are made on special molding machines designed by engineers of the firm. The machines are the squeeze, stripper type arranged so that the operator only has to throw one lever to operate the machine. Pulling out the lever swings the squeezer head from its idle position behind the machine, up over the machine platten so that it is the proper position for the squeeze. As soon as that position is reached the machine platten containing the pattern and flask filled with sand is forced up against the squeezer head through the action of a piston. As soon as the squeezing action is completed, the operator pushes the lever back. Then the machine platten drops and the squeezer head swings back behind the machine to its idle position. The machine platten continues to drop and the action brings the vibrator and stripper pins into operation. The latter of course, prevent the flask with its sand from continuing on down with the platten.

When the flask is stripped clear of the patterns on the platten, the operator removes it to a rack close by, and the platten continues to move down to the bottom of the piston stroke. At that point the vibrator action ceases, and the platten movement reverses. The reverse or upward motion continues until the platten reaches the normal position where the top of the platten is even with the tops of the stripper pins.

As may be observed in Fig. 1, flasks used for making piston rings are designed especially for the work. The form of the flask permits production of 6 rings with the minimum amount of sand. As is the usual practice in making piston rings, a sand or filler ring is used on top of the flask to give an additional height of sand for the squeezing operation. The ring is removed prior to that operation. Molds are stacked 16 high with a central sprue feeding the various cavities.



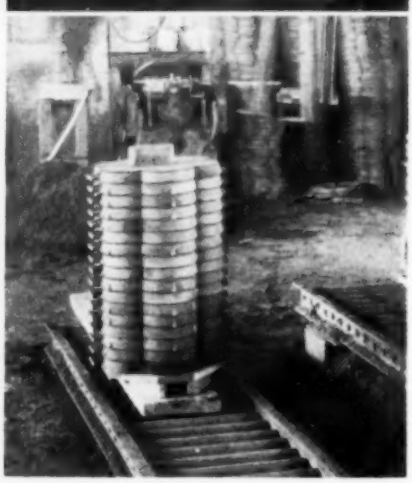


Fig. 3 (Top)—Manifolds are gated from the top. Fig. 4 (Bottom) —Stacks of molds on conveyor

Another interesting job made in the foundry is a manifold for one of the leading motor cars. The customer formerly encountered trouble in the cracking of manifolds, but through the use of electric furnace, alloy iron that difficulty has been eliminated. The iron used contains 1.75 per cent nickel, 0.50 per cent molybdenum and 0.35 per cent chromium with a total carbon content of 3 per cent. The molds are made in steel flasks using one 36 x 10 x 14 inches for the cope and 36 x 5 x 14 inches for the drag.

Drag molds for the manifold are made on a jolt roll-over molding machine supplied by the International Molding Machine Co., Chicago, and the copes on a jolt stripping machine manufactured by the Os- (*Please turn to page* 60)

Molybdenum in Steel Castings

Small additions of that alloy may prove economical through savings in other alloys

By H. W. GILLETT
and
J. L. GREGG

BEHAVIOR of molybdenum in the cast steels naturally is analagous to its action in similar wrought steels, always, of course, keeping in mind inherent differences which must exist especially as to ductility and impact in any cast metal, mainly due to the absence of *work*.

In steel of the usual carbon content for steel castings, especially if the manganese be kept at 0.5 or 0.6 per cent—that is, under what might be termed alloying amounts—moderate amounts of molybdenum produce little noteworthy increase in the conventional physical properties of the steel when in the annealed condition. However, in the normalized condition (due to the air-hardening effect of molybdenum) there is a rise of the yield point, an appreciable although less pronounced rise in the tensile strength, and thus an increase in the elastic ratio. With a low temperature draw of such normalized steels, static ductility and resistance to impact are raised without materially altering the strength figure attained in the simple normalizing.

Of prime importance in these steels is the marked increase in their high-temperature strengths. There is ample indication that simple annealed or normalized-and-drawn carbon-molybdenum cast steels have virtues for high temperature service not yet fully appreciated.

Outstanding properties conferred by molybdenum on steel ordinarily are noted only in the quenched-and-tempered condition of the steel. Molybdenum decreases the rate at which steel must be cooled to become martensitic. Accordingly, in proper amount and combination it tends to produce an air-hardening steel or, in lesser amount and with less of the other alloys, one hardenable by a mild air-quench.

Since it slows down so greatly the quick cooling rate usually necessary for hardening, centers of large sections of molybdenum-containing steels will *harden* much more fully than centers of carbon or molybdenum-free steels. This depth-hardening throughout a large cross-section makes feasible the air quenching of bulky or intricate castings that would not be amenable to air-quenching in the absence of molybdenum.

Martensitic molybde- (*Please turn to page* 59)

TABLE I

Analysis of Steels Considered in Investigation

Heat No.	Composition, Per Cent — C	Mn	Si	Other elements
2	0.32	1.51	0.29	0.47 Cr, 0.16 V
3	0.16	2.25	0.11	0.11 Cu
4	0.22	2.01	0.09	0.10 Cu
5	0.25	1.12	0.28	0.32 Mo
6	0.38	0.93	0.24	0.36 Mo
7	0.28	0.75	0.21	0.89 Cu
12	0.15	1.43	1.09	0.35 Cu
14	0.30	0.94	0.28	1.45 Ni, 0.17 V

TABLE II

Properties of Steel Castings Following Heat Treatment

NORMALIZED AT 1700 DEGS. FAHR., THEN 1525 DEGS. FAHR., AND FINALLY TEMPERED AT 1300 DEGS. FAHR.

Heat No.	Tensile Strength, lbs. per sq. in.	Yield Point, lbs. per sq in.	Elongation in 2 in., per cent	Reduction of Area per cent	Brinell Hardness	Izod Impact, ft.-lbs.
2	89,250	70,250	26.5	50.0	160	56
3	113,000	69,750	15.0	36.5	209	14
4	98,750	76,750	25.0	59.0	173	35
5	83,500	64,500	26.0	52.5	150	65
6	81,250	61,250	28.0	55.0	.....	.....
7	76,500	61,000	31.0	57.0	143	49
12	83,250	57,250	32.0	66.5	145	32
14	88,750	68,500	27.5	55.0	157	31–46

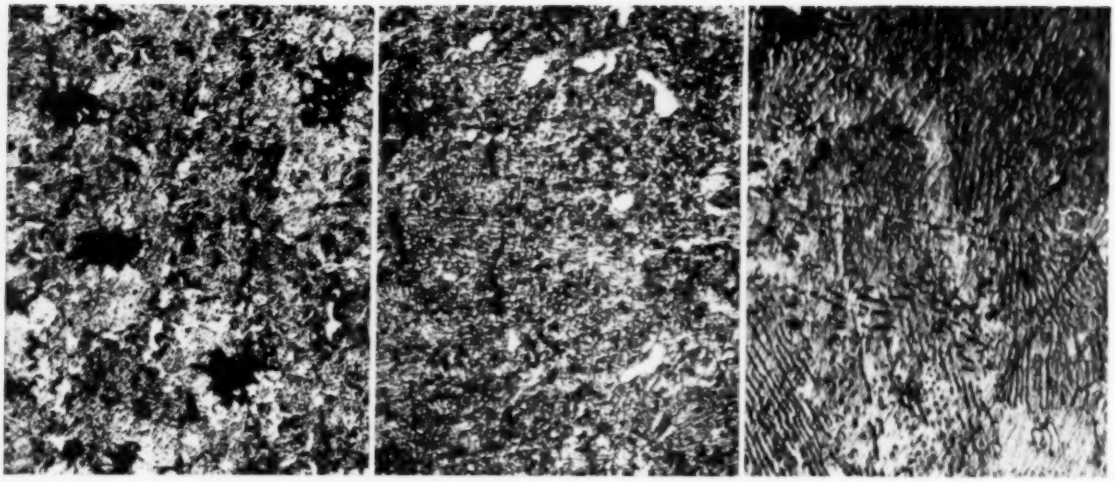


Fig. 1 (Left)—Structure of malleable iron with 0.22 per cent chromium and 1.10 per cent silicon. Etched: X100. Fig. 2 (Center)—Same iron X375. Fig. 3 (Right)—Same iron X800

Wear Resistance of Malleable Iron

Greatest strength derived from 0.84 per cent chromium and 1.57 per cent silicon

By REBECCA HALL
Metallurgist, Chicago

INCREASED strength and hardness are necessary in a wear-resistant malleable iron. In irons of the same base composition, increasing hardness indicates decrease of soft ferrite and increase of pearlite with correspondingly higher wear resistance. It is well known that the relationship between brinell hardness and wear resistance in many cases is controversial. However, for the purposes of the present investigation, brinell hardness figures fairly may be considered an accurate measure of wear resistance. The author has used brinell figures throughout.

Chromium was added to raise the hardness and strength. Silicon additions were made to counteract the inhibiting effect of chromium on the annealing process. For years, chromium has been taboo so far as the malleable

Table I

Varying Additions of Elements Reflected in Test Bars

Test Bar No.	Tensile Strength lbs. per sq. in.	Elastic Limit, lbs. per sq. in.	Elongation in 2 in., per cent	Brinell Hardness	Cr per cent	Si per cent
3211*	54,500	37,500	18.5	131	0	1.02
C-22-A†	70,000	42,400	11.0	175	0.22	1.10
C-22-B†	67,700	41,000	12.5	175	0.22	1.10
C-23	72,900	43,600	9.0	179	0.23	1.24
C-24-A	70,000	43,500	7.0	168	0.24	1.27
C-24-B	75,600	47,100	9.0	168	0.24	1.27
C-24-C	70,400	42,800	9.5	168	0.24	1.27
C-37	76,900	49,250	9.5	179	0.37	1.28
C-40	68,500	48,000	6.0	183	0.40	1.44
C-56	80,500	52,500	6.0	201	0.56	1.39
C-73	67,700	54,750	4.5	212	0.73	1.66
C-84	80,000	59,000	4.0	213	0.84	1.57
C-87	63,500	52,500	3.0	201	0.87	1.62
C-108	76,600	62,000	3.0	223	1.08	1.72
C-114	67,000	62,500	2.5	202	1.14	2.02

*Standard unalloyed malleable with total carbon 2.33, manganese 0.37, phosphorus 0.16, and sulphur 0.10.
†Silicon added in the form of zirconium-manganese-silicon.

Table II

Chromium Treated Iron Shows Increase in Strength

	Chromium-Silicon Malleable	A.S.T.M. Specifications 1930	A.S.T.M. Specifications 1910
Tensile strength, pounds per square inch	65,000	50,000	40,000
Yield point, pounds per square inch	40,000	32,500	.....
Elongation in 2 inches, per cent	7.5	10.0	2.5

foundry is concerned, because of this effect. Without additions of a graphitizing element such as nickel or silicon, chromium is dangerous in amounts over 0.07 per cent. Silicon will counteract the effect of chromium since it increases softness and favors formation of temper carbon. Therefore, it seemed logical to assume that by adding both chromium and silicon, the advantages of both and the disadvantages of neither could be obtained, as is accomplished in chromium-nickel steel, and a hard malleable iron with high strength and good ductility would result.

Experimental work was kept as practical as possible. Chromium was added in amounts

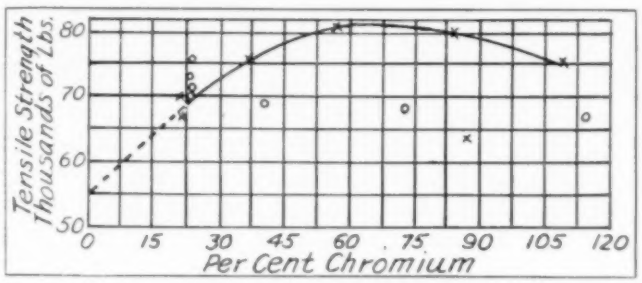


Fig. 4—Effect of increasing chromium on tensile strength. X shows iron where ratio of additional silicon to chromium is less than 0.71. O shows where the ratio lies between 0.71 and 1.05 per cent

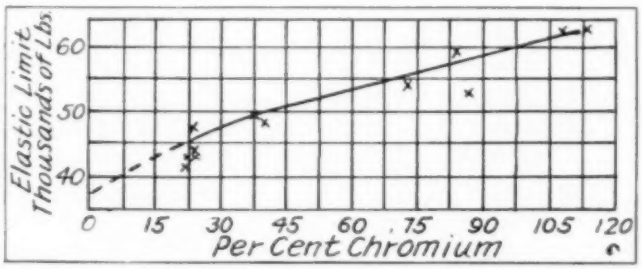


Fig. 5—Showing effect of increased chromium on elastic limit

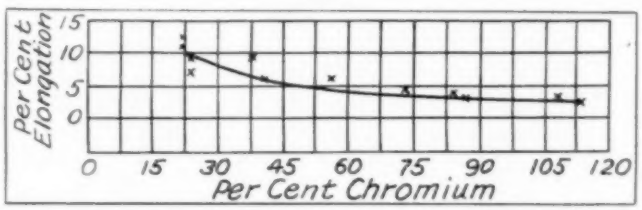


Fig. 6—Showing effect of increased chromium on elongation

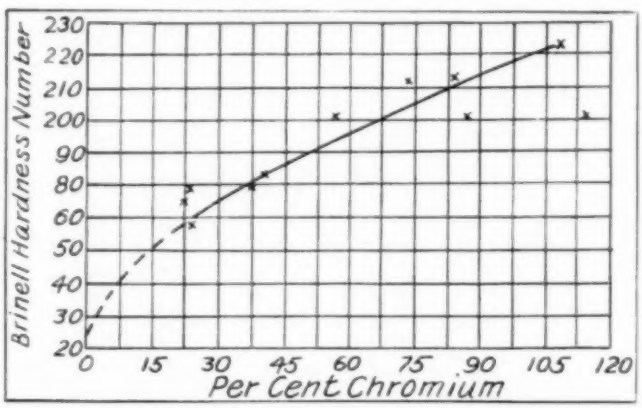


Fig. 7—Showing effect of increased chromium on brinell hardness

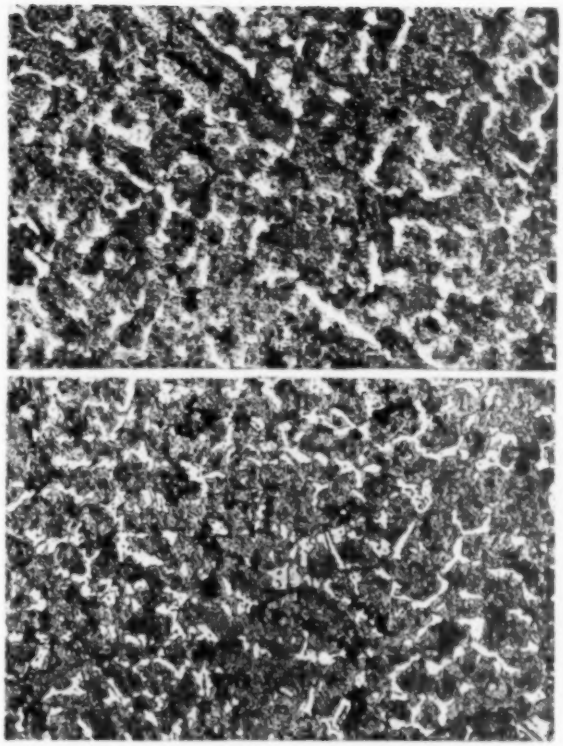


Fig. 8 (Above)—Structure of iron with 0.56 per cent chromium and 1.39 per cent silicon. Etched; X 100. Fig. 9 (Below)—Structure of iron with 1.14 per cent chromium and 2.02 per cent silicon. Etched; X 100

from 0.25 to 1.15 per cent with enough silicon to counteract its tendency to form stable carbides which might prevent the annealing operation. Earlier work indicated in a general way the amount of silicon necessary for this purpose, but two different percentages of silicon were added for each percentage of chromium to give more data on this ratio. All the foundry operations were carried out under accurate technical control.

The alloys used were ferrochrome (64.55 per cent chromium), ferrosilicon (90 per cent silicon), and in one case, zirconium-manganese-silicon (61.85 per cent silicon, 10.54 per cent manganese, 21.78 per cent zirconium). The special low-melting alloys, ground to 20 mesh and down, were used to insure complete solution in the ladle.

Additions of alloys were made in 50-pound ladles. The metal was poured back and forth twice to obtain thorough mixing, and the bottom of the ladle was carefully inspected to make sure that none of the alloy remained undissolved. Recovery was about 97 per cent for chromium and 95 per cent for silicon.

Test bars were poured in the standard malleable size, $\frac{5}{8}$-inch, and were given a standard 120-hour anneal at the usual temperature. They were pulled on a 100,000-pound tensile machine, the yield point being measured by a precise extensometer.

The general results are shown in Table I and in Fig. 4. (*Please turn to page* 62)

A. S. T. M. Features Gray Iron

Symposium at opening meeting presents most comprehensive survey of subject

THREE important phases of the work of the American Society for Testing Materials reached a high point of attainment at the thirty-sixth annual meeting held at Hotel Stevens, Chicago, June 26-30. Committees through which the society accomplishes so much in the scientific phases of testing were in session constantly from the opening day until late in the afternoon of the last day of the session. More than 125 committee and subcommittee meetings were held, attended by representatives of producers, consumers and the general public, through which the society maintains the balance in the standards which it provides.

From a foundry standpoint, the high point of this session was the presentation of a symposium on cast iron prepared jointly under the auspices of the A. S. T. M. and the American Foundrymen's association. This symposium which is covered in more detail in the pages following presents to the engineering world many new and valuable metals all grouped under the general heading of cast iron.

Prof T. R. Lawson
New President of the American Society for Testing Materials

A third factor which constituted this meeting, a high point in society affairs, was the Edgar Marburg lecture given by Dr. Herbert John Gough, director of science and philosophy, fellow of the Royal Society of Great Britain and the directing head of the National Physical laboratory in England. This lecture entitled "Crystalline Structure in Relation to Failure of Metals Especially by Fatgue" drew an attendance of over 300 members of the society and of the American Association for the Advancement of Science.

While the registration was below that of previous years, practically every line of endeavor of the society was represented and interest and activity was high at all sessions and committee meetings. The 1934 meetings will be held at Atlantic City.

In officially opening the A. S. T. M. convention on Monday morning, Cloyd M. Chapman, consulting engineer, New York, and president of the association pointed briefly to the part the engneering profession has played in the progress of the past century, as emphasized at the Chicago World's Fair. The first session of the annual meeting was devoted to a symposium on cast iron, and in introducing the subject, Mr. Chapman stated that on previous occasions the subject of cast iron had been discussed by the association, and as yet, the subject has by no means been exhausted. He then turned the meeting over to H. Bornstein, Deere & Co., Moline, Ill., as chairman and Dan M. Avey, THE FOUNDRY, Cleveland, as vice chairman.

Various parts of the symposium were discussed by members of the committee which has had charge of preparation of the work, as follows: "Introduction and Definitions" by H. Bornstein; "Metallurgy of Cast Iron," by John W. Bolton, Lunkenheimer Co., Cincinnati; "Properties of Cast Iron" and "Machinability of Cast Iron," by James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; "Corrosion Resistance and Heat Resistance of Cast Iron," by E. K. Smith, Electro Metallurgical Co., Chicago; "Classifications and Specifications," by W. H. Rother, Buffalo Foundry & Machine Co., Buffalo, N. Y.; "Heat Treatment of Cast Iron," by R. F. Harrington, Hunt-Spiller Mfg. Co., Boston; "White and Chilled Iron" by R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee; and "Welding" and "Recommended Design," by E. K. Smith.

In general, cast iron is defined as an iron

containing so much carbon or its equivalent that it is not malleable as cast. Following the brief section on definitions, the work takes up the history of cast iron and then discusses briefly methods of manufacturer and field of applications. The third section on metallurgy discusses various factors which influence properties of gray cast iron, such as carbon, silicon, manganese, sulphur, phosphorus, nickel, chromium, molybdenum, vanadium, copper, titanium, aluminum and zirconium.

Section four on the physical properties of cast iron indicates that the metal is used widely in engineering and allied industries because of the ease with which it may be cast, its low cost, and the wide range of physical properties. The report discusses in considerable detail data on tensile strength, compressive strength, transverse strength and deflection, elastic properties, shear strength, fatigue or endurance limit, impact or shock resistance, hardness, wear resistance, machinability, corrosion resistance, mass effect, heat effect, etc. Capacity for damping is mentioned in the text, and during the discussion which followed the presentation of the symposium, W. W. Kerlin, Gray Iron institute, Cleveland, pointed to that property as one of extreme importance to the designing engineer.

Discuss Additional Features

The A. S. T. M. tentative specification A48-32T is discussed in detail in the fifth section. Section six is devoted to heat treatment and provides discussions on annealing for three different purposes. To relieve internal stresses, to soften for machinability, and to anneal white or mottled irons as cast to obtain higher strength gray irons. Information also is given on quenching and drawing, and nitriding. The seventh section on white and chilled irons discusses heat treatment, hardness, effect of alloys on chilled and white iron castings.

To combat the difficulty of a hard area around the weld on cast iron, information has been included on the subjects of fusion welding, bronze welding, and electric welding. The final section discusses certain factors of design which may provide the basis for savings in the cost of manufacture and greater utility in service.

In the discussion, W. D. Coleman, Philadelphia, presented a written comment on the use of vanadium and titanium in cast iron, especially touching on some of the work which has been done in Europe. John Shaw of England complimented the committee highly for the work which has been accomplished and so ably presented. He mentioned that at last the foundrymen in the United States have come to recognize that the test bar must bear a relation to the cross section of the casting. He also stated that he does not consider the tensile test a true indication of the value of cast iron and that he favors greater use of the transverse test. Also, engineers should get together to decide upon the type of hardness tests that are to be made so that a fair method of comparison will be available. Others discussing the symposium included James T. MacKenzie, John W. Bolton, J. S. Vanick, International Nickel Co., New York, and W. G. Welling, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Discussion brought out the fact that this symposium represents the most extensive and valuable collection of data on the subject ever attempted. Touching, as it does, every phase of the subject, it should prove of especial value to engineers employing gray iron castings as engineering materials as well as the gray iron foundry industry as a whole. Written discussion on the work is invited so that all suggestions may be given proper consideration before the work is published.

The Monday afternoon session on "Cast Iron, Effect of Temperature on Metals" featured committee reports and papers, under the chairmanship of H. W. Gillett, Battelle Memorial institute, Columbus, O. The committee A-7 on malleable iron castings recommended that the tentative revision of the standard specifications for malleable iron castings, A47-30, proposed last year in the form of a separate tentative specification entitled A47-32T be referred to a letter ballot of the society. This report was adopted.

H. Bornstein, Deere & Co., Moline, Ill., as chairman of committee A-3 on cast iron, reported on the symposium on cast iron and the meeting on tests and specifications which were held as joint efforts with the A. F. A. He reported that the committee, at a noon meeting, had decided to hold the gray iron castings specification, A48-32T as tentative for further investigation. A recommendation to withdraw specifications A48-29 and A88-31, since they conflict with the present tentative specification, was accepted and will be referred to the membership of the society.

Report Covers Impact Tests

A report of probably the most important investigation ever sponsored by committee A-3, covering impact testing of cast iron, was presented by James T. Mackenzie, American Cast Iron Pipe Co., Birmingham, Ala. This report contains a comprehensive series of data on physical properties of cast iron.

Report of the joint research committee of the A. S. M. E. and the A. S. T. M. on "Effect of Temperature on the Properties of Metals" was presented by H. J. French, International Nickel Co., New York, and chairman of the committee. H. F. Moore, University of Illinois, Urbana, Ill., presented an abstract of the three appendices to the report. The meeting then voted to submit to letter ballot the proposed tentative method of test for long time (creep) high-temperature tension tests of metallic materials and proposed tentative method of test (*Please turn to page* 69)

Alloy Cast Iron with Titanium

Tests reveal that irons treated with that alloy have fine structure and high strength

By G. F. COMSTOCK

Titanium Alloy Mfg. Co.

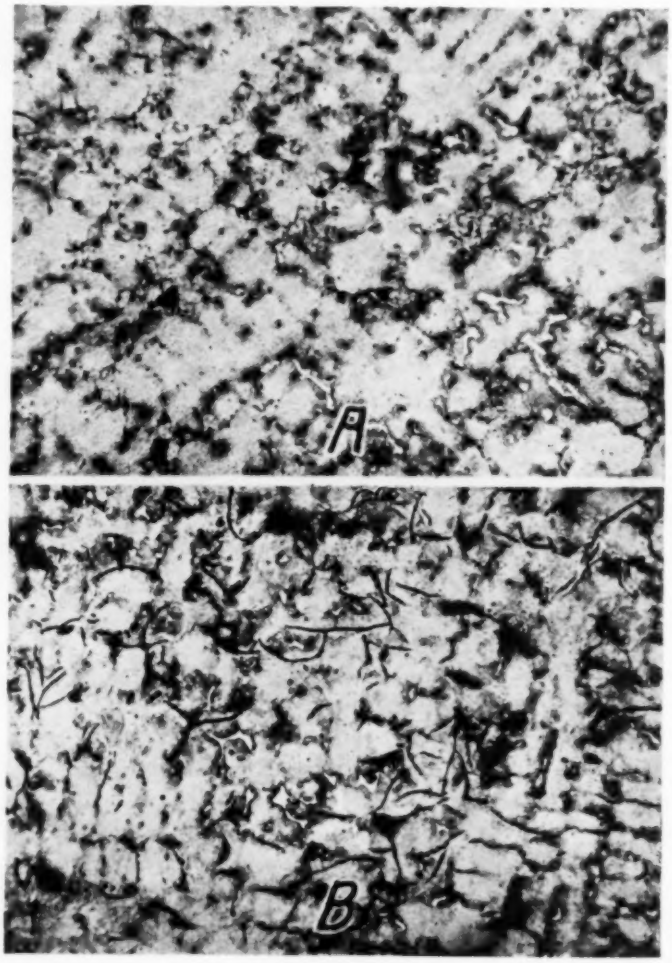
A NEW titanium alloy recently has been developed that is readily soluble in cast iron. The alloy has low contents of both carbon and aluminum and contains about 15 to 20 per cent each of titanium and silicon, the balance being iron. It will dissolve in small hand-ladles of cast iron at ordinary foundry temperatures, but the recommended method of use for the best efficiency is the same as for other alloys, or by dropping the alloy gradually in the stream of iron just as it leaves the furnace.

Preliminary tests at several foundries with alloy additions of from 0.5 to 2 per cent showed that the chief effect of titanium was to decrease the size of the graphite flakes, and that there also was a tendency to decrease the content of combined carbon and increase the formation of graphite and ferrite. The finer graphite in the titanium-treated iron generally caused an increase in strength as compared with the same iron untreated, the improvement in strength being as much as 25 per cent in some instances.

That this effect was due to the titanium content of the alloy, and not the silicon content, was shown by testing iron treated with corresponding amounts of ferrosilicon, when it was found that silicon alone produced coarser graphite and decreased strength. However, when too much of the titanium alloy was added so that the graphitizing effect was strong, there was too much ferrite in the titanium-treated iron, and the increase in strength expected from the refinement of the graphite flakes was lost.

This led to the idea of using a hardener such as chromium with the titanium alloy, to prevent ferrite formation, and allow the maximum improvement to be obtained from the finer graphite. Results in that direction were encouraging and several series of tests were made, in each of which the intention was to secure results from an iron of a definite constant composition untreated, treated with titanium, with chromium, with chromium and titanium, with chromium and nickel, and with molybdenum, respectively. This was best accomplished with electric-melted iron; in cupola practice it seemed to be difficult to get a series of irons with sufficiently constant silicon and carbon contents to permit accurate comparisons of the effects of the various alloys.

Results from four series of tests are present-



Microstructure about half way between center and edge of cross section of 1.25-inch diameter bar from series D, Table II, X100, etched with picric acid

ed in Tables I and II. These include all the trials in electric-melted iron that have been made, and the one trial in cupola iron that showed fair constancy of carbon and silicon contents throughout the series of tests.

The transverse test results are averages of from six to eight tests bars, with not over two rejections on account of surface flaws. These values were corrected for size of bar to a standard diameter of 1.25 inches. The bars were broken at slow speed, on supports 12 inches apart, with the beam automatically balanced; and the deflections were read from autographic stress-strain diagrams.

The tensile test results are averages from five tests made on the lower (as cast) halves of the broken transverse test specimens, with no rejections for flaws. These test-bars were machined to 0.8 inch diameter, with threaded ends, and pulled slowly with spherical-seated grips on the same machine with automatically-balanced beam.

The brinell hardness tests were made on cross-sections filed and smoothed with coarse emery, using a 10 millimeter ball applied with 3000 kilograms for 30 seconds.

The tests for resistance to cutting were made by O. W. Boston of the University of Michigan, using the tool dynamometer. The values given are merely readings of the instrument and show the comparative re- (*Please turn to page* 64)

Tests Provide Data on Titanium in Iron

CONSTANT improvement in the physical properties of cast products in recent years has solved many problems relating to suitable engineering materials for an ever extending field of applications. In the progress toward higher service possibilities of castings, alloys have contributed an important part. This article, which is abstracted from a paper presented at the recent Chicago convention of the American Foundrymen's association, discusses the effect of titanium as an alloy in cast iron. The study is based on a series of four tests, one on iron melted in the cupola and three on electric furnace metal. Check tests were run on irons without alloy additions. The data show a fine graphite in titanium alloyed irons, while excellent results in increased strength were obtained with titanium and chromium. The author is metallurgist, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Table I

Chemical, Mechanical and Cutting Tests

	Series A. Cupola Melted							Series B. Electric Melted						
Ferrotitanium added, per cent	None	1	None	1	0.5	None	None	None	1	None	1	0.5	None	None
Titanium content, per cent	0.042	0.102	....	0.108	0.075	....	....	0.051	0.147	0.072	0.138	0.105	0.087	0.084
Chromium content, per cent	....	....	0.32	0.39	0.41	0.39	....	....	....	0.56	0.54	0.48	0.62	....
Other alloy content, per cent	....	....	....	....	....	0.94 Ni	0.19 Mo	....	....	....	....	....	1.35 Ni	0.46 Mo
Silicon content, per cent	1.78	1.78	1.68	1.88	1.91	1.94	1.96	2.09	2.23	2.10	2.21	2.12	2.10	2.19
Graphite content, per cent	2.99	3.03	2.85	2.83	2.92	2.98	2.99	2.91	2.96	2.74	2.71	2.74	2.71	2.77
Combined carbon, per cent	0.50	0.49	0.64	0.67	0.60	0.56	0.49	0.55	0.51	0.73	0.72	0.70	0.70	0.62
Total carbon, per cent	3.49	3.52	3.49	3.50	3.52	3.54	3.48	3.46	3.47	3.47	3.43	3.44	3.41	3.39
Transverse strength, lbs.	4,115	4,500	4,340	4,628	4,560	4,448	4,428	4,450	4,673	4,823	5,004	4,835	4,789	5,093
Increase over untreated iron, per cent	....	9.4	5.5	12.5	10.8	8.1	7.6	....	5.0	8.4	12.4	8.7	7.6	14.4
Deflection, inches	0.132	0.143	0.138	0.138	0.133	0.137	0.144	0.153	0.149	0.145	0.146	0.145	0.139	0.170
Tensile strength, lbs. per sq. in.	30,860	32,460	33,780	35,240	35,280	32,400	31,000	33,820	35,660	36,520	38,700	37,240	38,640	38,960
Increase over untreated iron, per cent	....	5.2	9.5	14.2	14.3	5.0	0.5	....	5.4	8.0	14.4	10.1	14.2	15.2
Brinell hardness at center	183	183	183	192	196	187	179	187	196	202	207	187	207	202
Brinell midway between center and edge	187	187	192	196	207	179	183	187	196	207	217	207	217	207
Comparative resistance to cutting:														
Shaper test, 0.01 in. depth	53	55	....	53	....	55	55	....	....	....	....	....	....	....
Shaper test, 0.02 in. depth	85	86	....	84	....	87	86	....	....	....	....	....	....	....
Lathe test, 0.00313 in. feed	27.5	28.5	....	25	....	25.5	26.5	....	....	....	22.5	....	28.0	27.0
Lathe test, 0.00694 in. feed	39.5	43.0	....	38	....	39.5	39.5	....	....	....	37.5	....	41.0	39.0
Check Lathe test, 0.00313 in. feed	22	26.5	....	22.5	....	22.5	24	....	....	....	....	....	....	....
Check Lathe test, 0.00694 in. feed	36	40	....	36	....	39	37	....	....	....	....	....	....	....
Drill test, torque	18	17.5	....	18	....	18.5	17.5	....	....	....	19.0	....	20.5	20.5
Drill test, thrust	850	840	....	870	....	820	800	....	....	....	880	....	900	900

Table II

Chemical and Mechanical Tests of Cast Iron

	Series C. Electric Melted							Series D. Electric Melted						
Ferrotitanium added, per cent	None	1	None	1	1.5	None	None	None	1	None	1	1.5	None	None
Titanium content, per cent	0.042	0.114	....	0.126	0.138	....	....	0.026	0.054	....	0.098	0.143	0.051	....
Chromium content, per cent	Trace	....	0.72	0.74	0.73	0.75	....	....	....	0.34	0.38	0.43	0.36	....
Other alloy content, per cent	....	....	....	....	....	1.27 Ni	0.42 Mo	....	....	....	....	....	1.2 Ni	0.14 Mo
Silicon content, per cent	2.24	2.26	2.23	2.25	2.24	2.24	2.24	1.61	1.64	1.60	1.65	1.69	1.64	1.62
Graphite content, per cent	2.49	2.54	2.35	2.34	2.34	2.36	2.47	2.59	2.56	2.43	2.42	2.36	2.46	2.48
Combined carbon, per cent	0.68	0.64	0.83	0.82	0.84	0.81	0.69	0.61	0.60	0.71	0.74	0.79	0.68	0.64
Total carbon, per cent	3.17	3.18	3.18	3.16	3.18	3.17	3.16	3.20	3.16	3.14	3.16	3.15	3.14	3.12
Transverse strength, lbs.	4,400	4,512	4,390	4,930	4,625	4,672	4,362	4,092	4,350	4,243	4,660	4,926	4,705	4,595
Increase over untreated iron, per cent	....	2.5	....	12.0	5.1	6.2	....	....	6.3	3.7	13.9	20.4	15.0	12.3
Deflection, inches	0.125	0.134	0.107	0.112	0.110	0.106	0.115	0.108	0.115	0.110	0.118	0.126	0.128	0.135
Tensile strength, lbs. per sq. in.	38,840	39,900	43,020	46,680	45,980	42,940	44,300	37,600	39,600	36,740	41,720	41,260	42,100	40,440
Increase over untreated iron, per cent	....	2.7	10.8	20.2	18.4	10.5	14.0	....	5.3	....	11.0	9.6	12.0	7.6
Brinell hardness at center	192	196	217	223	217	217	217	207	207	212	217	228	223	207
Brinell midway between center and edge	196	207	223	235	235	223	228	212	207	212	217	228	223	207

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Brass Pump Castings Leak at Changes in Section

We are having difficulty in making sound brass pump castings. These castings leak at the points indicated. Metals we have tried include 60 per cent copper and 40 per cent zinc; 88 per cent copper, 10 per cent tin and 2 per cent zinc; 85 per cent copper, 5 per cent tin, 5 per cent zinc and 5 per cent lead; 86 per cent copper, 6 per cent tin, 4 per cent zinc and 1 per cent lead. The metals are melted in coke-fired pit furnaces using ingot metal. We have tried molding the castings on the side and also upright. However, when the castings are subjected to a water test of 200 pounds per square inch, many of them leak badly.

It would seem that the pump bodies you are having trouble with have an extraordinarily thin wall. On this account, where the thicker sections join this wall, the contrast between thick and thin sections is so extreme that at their juncture the solidifying rate of the metal due to heat radiation is disproportionate and causes undue shrinkage to take place at these points.

Your problem, therefore, becomes that of feeding the points where shrinkage occurs and risers are the only answer unless the designers permit such a change in the design of the body as to remove this marked contrast between the thick and thin sections.

You will note that practically all of your leaks occur where a thin section and a thick section join. Of course, it is possible to be lucky and get a few good castings without properly feeding them by risers. It would then seem that if a few could be made, any quantity could be made; but this conclusion is not justified if we were to examine the structure of the metal in the castings to be assumed to be good, when the shrinkage would be apparent. It is only by good luck that they do not happen to leak.

You might try gating the casting at the heavy lug 1 11/16-inch diameter and flowing the metal through the casting and out through a riser at the other end, thus washing a sufficient amount of hot metal through the mold to give a relatively uniform temperature gradient from one end of the casting to the other. By doing this and possibly adding other risers at very heavy sections, your leaker loss should be greatly reduced; but the best cure would be to redesign the pump body so as to do away with extreme contrast between thick and thin sections before machining.

Practically Any Close Grained Iron Is Satisfactory

What mixture of gray iron would you advise for castings used in machines for pressing out olive oil so that it will not absorb any taste or flavor from the metal? Would a gray iron mixture containing antimony be of value for that purpose or any other?

If the olive oil is not rancid and is free from water, almost any close grained iron will do, and the mixture should be chosen on the basis of the mechanical properties required in the sections under consideration. If by any chance the triglycerides are partly decomposed with the resultant formation of free fatty acids, or if water is present, some corrosive attack on the iron is likely. That will result in the formation of iron soaps or other compounds which may impart a peculiar taste and a dark color to the oil. (If free fatty acids are present, these in themselves impart a bad taste to the oil.) Claims have been made that small amount of certain elements, notably chromium, impart increased corrosion resistance to some corroding agents, but it is doubtful if they would be of material benefit in this particular case. Austenitic irons of the 15 per cent nickel, 5 per cent copper and 1.5 per cent chromium class resist vegetable acid oils much better than any of the regular gray irons, but cost more to produce.

Antimony has a similar effect on gray iron as

has tin, that is making it hard and brittle. It is claimed that additions of antimony are beneficial to the 14 to 16 per cent silicon irons, and a patent has been granted in Germany on corrosion resisting iron containing from 0.5 to 5.0 per cent antimony with small amounts of copper, arsenic and tin, and possibly nickel, aluminum, and magnesium. However, we doubt that small additions of antimony would be beneficial chemically, and are undesirable mechanically.

Better Skin Is Obtained Without Coating Metal Molds

We would like to know what kind of a solution is recommended for coating permanent molds used for producing aluminum alloy castings.

Considerable difference of opinion exists on whether metal molds for aluminum alloy castings should be coated or not, and it seems generally to be admitted that a better skin is obtained without the use of a coating. A variety of coatings are used and have included linseed oil and tallow. Now lime or whiting mixed with water, with or without water glass, seems to be preferred. The coatings usually are employed as an insulating medium on those portions of the mold where it is desired to reduce the chilling effect, for example on the gate portion.

One mixture that is used is composed of 1 part of lime in 1 part of water; another is similar in composition except that some sodium silicate (water glass) is added. A third mixture contains 12 pounds of whiting, 1 pound of plumbago, 6 gallons of water and ½ pint of water glass. A mixture of high grade fireclay, water and sodium silicate sometimes is used for coating the gate section to retard freezing at that point. The molds should be heated up before any of the coatings are applied so that the coating will dry rapidly.

Content of Vanadium in Bronze Is Variable Quantity

Have you any information on the analysis and method of casting vanadium bronze?

It is our impression that vanadium bronze is a patented composition. Two analyses given in Campbell's *List of Alloys*, published by the American Society for Testing Materials are as follow: Copper 61 per cent; zinc, 38.5 per cent, and vanadium, 0.5 per cent—Copper, 70 per cent; zinc 29.5 per cent and vanadium, 0.5 per cent. From that it may be seen that the composition is similar to manganese bronze minus the iron, aluminum and manganese, and undoubtedly the methods employed in molding and casting follow those for manganese bronze. A recent patent gives the following composition of a vanadium containing nonferrous alloy: Copper 40 to 80 per cent; nickel, 10 to 30 per cent; aluminum, 6 to 9 per cent; zinc, 6 to 9 per cent, and vanadium from an effective amount up to 5 per cent.

Plow Point Manufacture Is Specialized Operation

I am seeking information on the manufacture of cast plow points and other plow castings. Can you advise me of any text covering this subject giving data on mixtures, molding practice, etc.?

Manufacture of plow points and other plow parts is a specialty operation, and requires skill and experience as without those considerable grief and trouble will be encountered. As far as we know, there is no book relating to the subject. Plow points are made from mixtures containing from 90 per cent scrap and 10 per cent pig iron to 50 per cent scrap and 50 per cent pig iron. The analysis will range from 1.40 to 1.85 per cent silicon; 0.50 to 0.75 per cent manganese, and 0.25 to 0.40 per cent phosphorus. The metal is poured at not less than 2500 degrees Fahr. to obtain the desired chill and eliminate any snaky appearance on the surface. Plow points usually are made two in a flask on stripping plate molding machines making a cope and drag at the same time. The molds are stacked one on top of the other to a height of 3 feet or so, and shifting the ladle from one mold to the next is accomplished with a special pouring device.

Chilled mold boards are made one in a flask. The drag side of the mold is an iron plate forming the chill. The cope is made in green sand. A typical analysis for that type of work contains 0.90 per cent silicon; 0.20 per cent phosphorus, and 0.50 per cent manganese. Methods employed

in the production of plow points and other plow castings are presented in Nov. 1, 1920; Dec. 1, 1929 and Dec. 15, 1929 issues of THE FOUNDRY.

To Cast Steel in Small Diameter Pipe

I want to make a pipe 10 feet in length, 1¼-inch inside diameter and 1½-inch outside diameter. This pipe is to be cast from converter steel and poured in an iron mold. What is the cheapest way to make this pipe in the foundry, by the centrifugal process, or, by the use of a core?

Your proposal to cast a steel pipe 1¼-inches inside diameter, ⅛-inch thickness of metal and 10 feet in length, is not within the range of practical accomplishment either by the centrifugal process, or by the use of a core to form the inside. The total quantity of metal is so small, the wall of the pipe is so thin, and molten steel solidifies so rapidly, that it is idle to attempt to produce the pipe in a spinning mold by the centrifugal process. Similarly, the difficulty of developing a suitable core, and later of holding that core in place in the mold, and still later of removing the core from the casting, constitutes an insurmountable barrier against the second proposed method.

Aluminum Alloy For Permanent Molds

Can you give me any information on an aluminum alloy which will give smooth, even castings, not too brittle, when cast in metal molds. The castings are chandelier parts, not over 14 inches in diameter, open design, approximately ¼-inch thick, and weighing from 3 to 5 pounds. Also what metal should the molds be made from?

A number of aluminum alloys are used for making permanent mold castings. One which is used to considerable extent is a variation of the standard 8 per cent or No. 12 aluminum alloy. The alloy has the following range of composition: 6 to 8 per cent copper; 1 to 1.5 per cent iron; 1.0 to 2.5 per cent zinc, and remainder aluminum. Another alloy that is receiving considerable attention especially in the manufacture of cooking utensils in permanent molds is that containing 5 per cent silicon and 95 per cent aluminum. A third alloy is one containing 4 per cent copper; 5.5 per cent silicon, and the remainder aluminum. For your purpose the first mentioned alloy probably will be the cheapest. The alloy may purchased in ingot form as virgin metal or as secondary metal. In the latter case it is advisable to purchase from a reputable source.

Permanent molds for casting aluminum alloys usually are made from dense, fine-grained gray iron, and undoubterly you will have to undertake considerable experimental work to determine proper method ot gating and risering the mold. Also in designing molds, it is advisable to shape them so that a uniform metal section is obtained around the casting. That is necessary to obtain uniform stresses throughout the mold during the repeated heating and cooling.

Skillets Are Made In Fine Molding Sand

We shall appreciate any information you can give us on the proper grade of sand to employ in the molds for skillets, a suitable analysis for the iron and any other advice that will be of assistance.

In different sections of the country the word skillet is applied to: A—a frying pan; B—any small or shallow pot or dish used in cooking; C—a small pot provided with three short legs on the bottom, a lid on the top and a handle or bail for suspending it over a fire. In your state the word skillet is used extensively in reference to a circular flat cast iron or steel dish, provided with a long handle. Throughout the Eastern states this device is known as a spider. In the present instance we shall assume that you are referring to the cooking device recognized by every person under the title frying pan and known colloquially in various places as a skillet or spider.

Quite probably the sand and iron you are using at present in the production of light iron castings, will serve for the skillets. These castings are quite thin, therefore any fine sand that is reasonably refractory will make satisfactory molds. No special iron is needed. By that is meant that iron of widely varying composition may be poured into these castings. For example the silicon may vary between 2.25 and 3.00 per cent, sulphur up to 0.10 per cent, phosphorus from 0.20 up to 1.00 per cent; manganese from 0.30 to 0.90 per cent. In other words the castings may be poured from any ordinary mixture.

The pattern is dropped into a follow board so that when the drag is rolled over the mound of sand forming the inside of the proposed casting remains on the drag. In foundry parlance the casting is all made in the cope. To secure a clean and shining surface the pattern may be faced with sand containing coal dust in the proportion of 1 to 12. Some foundrymen prefer to omit the coal dust. They shake blacking on the surface of the mold or paint it lightly with a camels hair brush. Others again depend on the tumbling barrel to produce a clean surface. In modern practice the inside surface of the casting is finished by grinding. Metal is poured into the mold through a single wedge gate located approximately on the center of the pan bottom. If you have kept a file of back copies of THE FOUNDRY you will find interesting references to hollow ware in the issue of April 1 and April 15, 1921 and gating methods for the same class of castings in the Nov. 1, 1931 issue.

White Iron Used For Grinding Burrs

Can you give information on what compositions of chilled cast irons generally are made? Also what particular composition will result in the hardest chilled iron suitable for burrs in coffee grinders?

Chilled iron ordinarily has a gray fracture if allowed to cool under usual conditions, but that portion cast against a heavy metal chill is cooled rapidly causing a white or nearly white fracture at that point. If the metal chill is comparatively light with respect to the section of the casting, the structure remains gray at that point, but has a fine grain. Light metal chills usually are called condensers as they generally are used to densen the metal where applied.

Chilled iron differs considerably from white iron which is the material you should use for the grinding burrs. White fracture of such iron is obtained by lowering the silicon so, that under ordinary conditions of cooling, the fracture remains white. For small grinding burrs the silicon should be around 0.70 per cent. Several mixtures are used, and any of the following may be tried: One is composed of 50 per cent malleable pig iron containing 1 per cent silicon, and 50 per cent return white scrap. Another is composed of 50 per cent malleable pig iron; 15 per cent gray iron scrap; 20 per cent return white iron scrap, and 15 per cent steel scrap. A third mixture is comprised of 40 per cent malleable pig iron; 15 per cent gray iron scrap; 20 per cent return white iron scrap, and 25 per cent steel scrap.

The mixtures given may work satisfactorily, but if they do not, you will have to vary the content of the various raw materials until the desired results are obtained. You can see from the mixtures mentioned that there are no hard and fast rules to be observed. However, it may require a little experimental work to determine the most suitable composition for the work in hand. White irons are sluggish, and in consequence must be melted hot, and poured rapidly. The metal should be poured into the mold with all possible dispatch.

Viewing Foundry Developments

At Short Range

A PRODUCER of centrifugal castings eliminated cracking and seaming of the cast iron dies in which various ferrous and nonferrous metals are cast by alloying the dies with 1 per cent of molybdenum. It is claimed that in addition to lengthening the life of the dies, the molybdenum addition eliminates sticking of the casting after solidification.

♦ ♦ ♦

Pouring of moderate amounts of metal at frequent intervals during the day conserves floor space and molding equipment. A recent case in point is a foundry using a 3000-pound electric furnace of the rocking type. Only 35 of the flasks used for making heavy truck brake drums were available, while 100 drums per day were required. The rapid pouring schedule of the electric furnace made is possible to secure the 100 drums from the available flask equipment, thus avoiding considerable expense necessary where the entire floor is poured at the close of the day.

♦ ♦ ♦

LABORATORY tests have confirmed previous observation in various plants throughout the country that soda ash added with the cupola charge accelerates combustion reaction. This results because the soda ash makes a more fluid active slag which serves to keep the coke surfaces clear for better contact with oxygen in the blast, and because sodium acts as a catalyst in accelerating combustion reaction.

♦ ♦ ♦

Spectroscopy is the somewhat formidable term applied to a science which is beginning to find application in the foundry through one of the branches, spectrum analysis. Through a clever combination of camera, prism and mirrors, a characteristic film is obtained of any desired specimen. By close observation of the marks on the film the skilled operator can determine the relative amount of each of the elements involved.

♦ ♦ ♦

In making high chromium steel castings containing up to 25 per cent chromium, it has been found that the addition of nitrogen toughens the castings and provides a fine grained casting without affecting the machinability. The nitrogen is introduced through the use of a special grade of ferrochrome.

♦ ♦ ♦

By using a strongly excess oxygen flame for both preheating and welding, when fusion welding bronzes which contain relatively high amounts of tin or lead, the tendency for those constituents to boil out is said to be eliminated.

♦ ♦ ♦

EARLY researches, confirmed by more recent practice, have shown that a minimum of 20 per cent of nickel must be added to an ordinary cast iron base to give an austenitic structure. For practical purposes in this case it generally is found desirable to increase the amount of austenite-forming elements to 3 to 5 per cent above the minimum value, to insure castings that are fully austenitic in all sections and under all conditions.

♦ ♦ ♦

A French automobile manufacturer employs an aluminum alloy analyzing 91 per cent aluminum, 8 per cent copper, 0.60 per cent iron, 0.40 per cent silicon and 0.10 magnesium. For die cast work the alloy consists of 87.10 per cent aluminum, 12 per cent copper, 0.50 per cent iron, 0.30 per cent silicon and 0.10 per cent magnesium.

♦ ♦ ♦

Summer brings a market for equipment to be used on picnics, camping, etc. One foundry is making a portable cast iron grill in which charcoal is burned. Another foundry is making a heavier and larger iron grill for permanent installation on picnic grounds.

♦ ♦ ♦

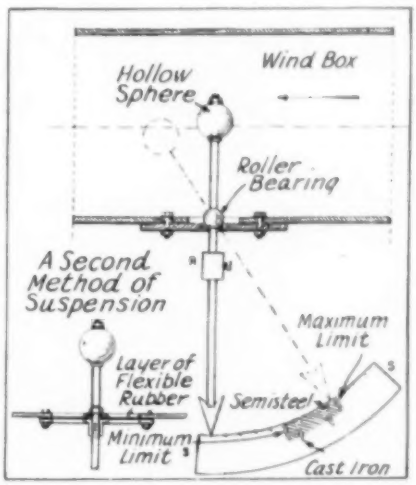
A new bronze of high strength which is suitable for casting, recently has been developed. The alloy contains 96 per cent copper, 3 per cent silicon and 1 per cent zinc.

♦ ♦ ♦

IT OFTEN is desirable to cast in inserts of other metals in an aluminum sand casting. For such inserts, cast iron or steel is the most suitable material. Copper, brasses and bronze will dissolve partly or entirely in the molten aluminum.

♦ ♦ ♦

Several French foundries have installed the equipment shown in the accompanying illustration to give direct readings of the pressure in the wind box. Dimensions of various parts of the apparatus are determined by experiments. The position of the counterweight is adjusted in such a way that maximum freedom of movement of the ball bearings shall be



greater than the largest variation resulting from the pressure to be measured. The sector or quadrant is marked off according to a scale, using the Pitot-Ritter gage to determine the desirable maximum and minimum pressures. The normal pressure is indicated by a heavy line, and the upper and lower limits, which are not to be exceeded, also are indicated.

The FOUNDRY Family Photograph Album

Upper Left
F. A. LORENZ JR.
American Steel Foundries
Chicago

Upper Right
E. E. GRIEST
Chicago Railway Equipment Co.
Chicago

Lower Left
C. S. ANDERSON
Belle City Malleable Iron Co.
Racine, Wis.

Lower R'ght
ALBERT WEBER
Wilson Foundry & Machine Co.,
Pontiac, Mich.

Men of Industry

Whose Activities Are Making Foundry History

PROF. T. R. LAWSON, recently elected president of the American Society for Testing Materials, has been head of the department of civil engineering, Rennselaer Polytechnic institute, Troy, N. Y., since 1921. He was graduated from Rennselaer in 1898 with the degree of civil engineer and has been affiliated with that institution continuously since that time. He was successively instructor and assistant associate professor and since 1908 has been professor of rational and technical mechanics.

Professor Lawson has taken a leading part in many of the extensive research investigations conducted by the Rennselaer Polytechnic testing laboratory, especially tests on welded structures. He has taken an active interest in the A. S. T. M.; for the past 3 years has been chairman of the society's important committee on standards, is a member of the committee on brick, slate and on methods of testing, and from 1928 to 1930 was a member of the executive committee. He also is a member of the American Society of Civil Engineers, American Concrete institute, Clay Products institute and American Welding society.

✿ ✿ ✿

F. G. MORLEY, a director of the Great Lakes Engineering Works, Detroit, has been elected president to succeed the late John A. Ubsdell. George B. Turnbull and John T. Webster continue as vice presidents.

✿ ✿ ✿

HARRY S. RANSOM recently was appointed special sales representative in the Pittsburgh and Eastern Ohio districts for the Ft. Pitt Steel Castings Co., McKeesport, Pa.; Cleveland Hardware & Forging Co., Cleveland; and the Calorizing Co., Pittsburgh.

✿ ✿ ✿

HARRY A. SCHWARTZ, director of research, National Malleable & Steel Castings Co., Cleveland, received the honorary degree of Doctor of Science from Rose Polytechnic institute, Terre Haute, Ind., June 10. Mr. Schwartz was graduated from that institution in 1901.

✿ ✿ ✿

J. B. GREENSTREET, for the past 16 years general superintendent, Olney Foundry Co., Philadelphia, a subsidiary of the Link-Belt Co., has been made superintendent of the foundry divisions, Textile Machine Works, Reading, Pa. During the past year Mr. Greenstreet served as president of the Philadelphia Foundrymen's association.

✿ ✿ ✿

J. T. JACKMAN has resigned his position with the R. K. O. Studio, Hollywood, Calif., to become associated with F. A. Dilliard in the firm of Dilliard & Jackman Inc., specializing in the manufacture of castings used exclusive in short wave radio broadcasting. Mr. Jackman was the author of the article "Castings Star As Movie Props," presented in the October, 1932 issue of THE FOUNDRY.

J. B. Greenstreet

Book Review

The Development of Economics, by William A. Scott, cloth, 540 pages, 5¾ x 8¾, published by The Century Co., and supplied by THE FOUNDRY, Cleveland, for $4, plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This objective survey of the development of economics offers a new and relatively easy approach to a complex subject. It organizes its material around the development of the classical political economy of England, considering first, the background of that development in the economic life and thought of the preceding period; the development itself; and finally, the attempts to reconstruct the science in the post-classical, including the contemporary period.

The author, who is emeritus professor of economics, University of Wisconsin, indicates that we are now in the development of economics and points to the reasons for the changes in doctrines that have constituted the science in the different periods in its history. By omitting or subordinating the details of history and emphasizing the most important and significant developments, and by tracing the changes in economic conditions, institutions and theories and revealing their relationship, the author makes this study more easily comprehensible to both students and the general reader.

Made Vice President

A. S. Nichols, sales manager, Illinois Clay Products Co., Joliet, Ill., recently was elected vice president and secretary of the company. Mr. Nichols was connected with the Harbison-Walker Refractories Co., Pittsburgh, until 1927 when he become connected with the Illinois Clay Products Co. as sales manager. He is well known in the foundry industry through his development work in the field of insulation problems and refractories.

Has New Address

Sullivan Machinery Co., Chicago, has combined its St. Louis district sales office, formerly located at 2015 Railway Exchange and its warehouse, formerly located at Mt. Vernon, Ill., to a new address at 2639-41 Locust avenue, St. Louis. D. M. Sutor is manager there and a complete stock of parts for air compressors, highway drills, drill sharpeners, hoists, coal cutters coal loaders, cutter bit sharpeners and diamond drills will be carried.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Beware of Scrap

TO THE EDITORS:

The interesting article "Removing Aluminum from Red Brass" in a recent issue THE FOUNDRY could have been enhanced with a reminder to the foundryman that he is in business primarily to make and sell castings. The encroachment of other methods and materials in the nonferrous field has placed such pressure on the foundryman that it behooves him to select proper materials for his purpose. He cannot afford the experiment of trying to make silk purses out of sow's ears. Removing aluminum from a 10 per cent aluminum bronze and using the residual copper as a base for red brass is doing just that. Nor would I advise using the bronze as a hardener for a No. 12 aluminum, for reasons I shall touch upon later.

If there is a large amount of metal contaminated with aluminum, the place for it is in a refinery. Refining metals is no part of a foundryman's business. As for being able to tell by the zinc flame when all the aluminum has been removed, that is on a par with determining the temperature with the naked eye. It is out of date, it is unscientific.

Let us suppose the zinc flame test shows that the aluminum is all gone. The castings are poured. True the sprue shows a little gray. Well, that can be zinc smoke. However, the castings look fine and machine beautifully. They are sent to the test and the tester facetiously asks the foundryman "If the castings are a new idea for a lawn spray?"

What has happened? The molder's time; the metal; machining time and cost, all have been wasted. Maybe an important job has been held up, but worse than all the foundry has received a black eye.

To go back to the aluminum bronze. As the writer of the article remarks, it is an extreme case, used merely as an illustration. The best aluminum bronze is made of copper and a hardener composed of 90 parts aluminum and 30 parts steel. It is the latter that makes it unsuitable for a hardener for No. 12 aluminum. A 10 per cent aluminum bronze contains 86.66 per cent copper; 10 per cent aluminum and 3.33 per cent iron. This is heated to 2400 degrees Fahr.; quite a high temperature for a brass furnace. This superheat is held while 32 pounds of barium sulphate per 100 pounds of metal is added in relays and so farewell aluminum and we hope, the iron. This refining idea is all right in a steel foundry. The superheating is the basis of high test iron, but it should be taboo in a brass foundry. A large number of foundrymen who contend they melt brass at 2300 degrees Fahr., would find that unnecessary if they paid more attention to the proper heating of their pouring ladles.

Why this fetish for the use of scrap? Consider the query on page 48, June issue of THE FOUNDRY. The inquirer frankly states that he uses miscellaneous scrap, copper wire and a proprietary brass cleanser. His method is as wrong as his materials. He slowly melts the copper wire and then adds the scrap. Adds to what? To a mass of cuprous oxide that all the brass cleanser in the world couldn't cure. He states that his castings often have holes and appear spongy.

I wonder what is his objection to using a composition ingot of the analysis he desires. There is a special class of castings for which I would use virgin metal. I don't mean by that copper wire for copper, lead pipe for lead or tin cans for tin. For other castings a composition ingot is safer, far less risky and in the long run as cheap as scrap.

Scrap is risky under nearly all conditions. For example, a foundry with which I was connected made all the bronze and brass castings for a large manufacturer. One day we had a visit from the local scrap dealer with the offer of a large amount of scrap bought from our customer. This scrap consisted of old castings that had become obsolete, parts removed when making repairs, etc. The collection contained 18 gear castings similar to those we made regularly, composition 88-10-2. Acting on a hunch I had an analysis made as the color did not look good. The analysis showed quite a high percentage of aluminum. A closer inspection showed that 15 of the 18 were aluminum bronze.

We made high pressure castings in weight up to 600 pounds. Each of the gears weighed 45 pounds, so any person readily can imagine the headache I should have developed had I accepted the official's word. He thought he was getting a bargain and assured me he was positive the gears were similar to the gears we poured from 88-10-2 metal. The collection also contained some large hooks similar to those we supplied on various occasions. In this instance a close examination showed that 90 per cent of the hooks were steel bronzed over.

Far better than knowing how to remove aluminum from red brass is to make sure that it isn't there. Safety is insured by purchasing proper materials. There are just three fundamentals for the production of a perfect casting: A mold properly made; cores properly made and dried; and good metal properly melted and poured. These are the essentials of good foundry practice. I have used large amounts of barium sulphate for other purposes than removing aluminum. I have handled tons of contaminated metal successfully, but my advice still is DON'T!

JOHN DUFFY

Brooklyn, N. Y.

Pittsburgh Group Holds Summer Outing

Pittsburgh Foundrymen's association held its outing June 12 at the Alcoma country club, Pittsburgh. Approximately 100 attended. A golf tournament was held in the afternoon at which the five lowest gross scores for the 18-hole course were turned in as follows: A. E. Sherrick, American Steel Foundries, 82; William Bulmer, 84; W. H. Nichols, Pittsburgh Rolls Corp., 85 E. A. France Jr., THE FOUNDRY, 89; and A. R. Berg, Mesta Machine Co., 89. The lowest net score was turned in by P. E. Templin, National Malleable & Steel Castings Co., 101-40-61 followed by A. R. Berg, Mesta Machine Co. with 89-23-66.

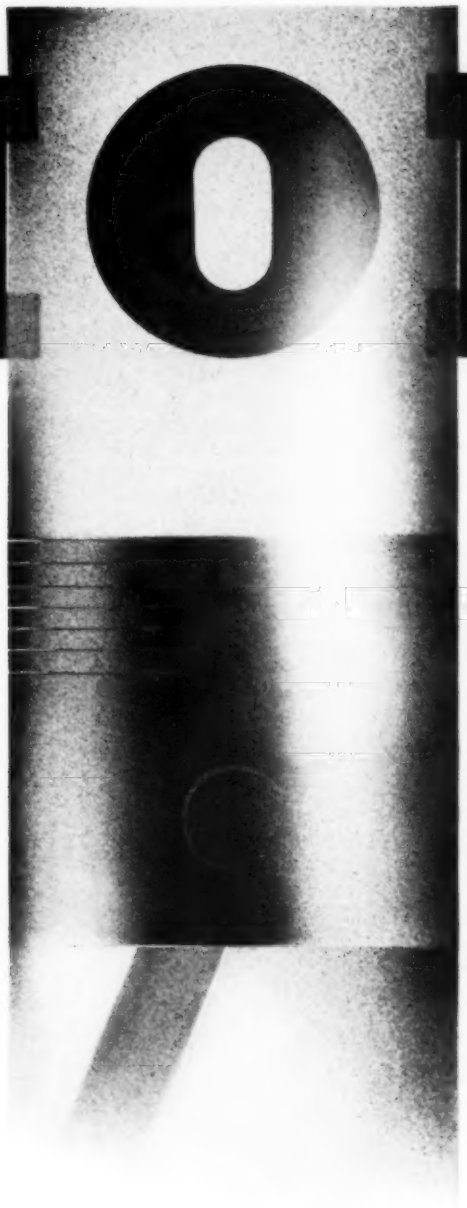
Elect Officers of New Jersey Association

The New Jersey Foundrymen's association recently elected the following officers for the coming year: President, H. L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J.; vice president, P. R. VanDuyne, Meeker Foundry Co., Newark, N. J.; treasurer, J. A. Williamson, Isbell-Porter Co., Newark, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J.

The first fall meeting of the association will be held on October 25.

Quad-City Foundrymen's association held its eleventh annual picnic on June 17 at Maple Lake Inn on Rock river near Moline. A program of sports was provided for the afternoon and a dinner was served in the evening.

MOLY



GIVES GREY CAST IRON OUTSTANDING RESISTANCE TO ABRASION

MOLYBDENUM, long famous in the steel industry for making good steel better, is equally valuable to iron founders—producing results not readily duplicated by any other commercial alloy.

It adds a toughness to frictional parts that stubbornly defies wear. It increases tensile strength from 20 to 40% — transverse strength, 25 to 40% — fatigue strength, 25% — impact strength, 50 to 100% — and the Brinell hardness, 10-50 BHN. Yet, a Moly iron will machine *better* at the same Brinell hardness than an unalloyed iron. One foundryman has *doubled* the roughing machining speed on his lathe beds by the addition of 0.50% Molybdenum.

Let us show you how Moly, *at very low cost*, can improve the qualities of both cupola iron and the highest grade electric furnace iron. The modern Climax laboratories in Detroit are at your disposal for any test you care to make. Write for complete information about our free engineering and experimental services and ask for interesting booklet: "Molybdenum in Cast Iron." Climax Molybdenum Co., 295 Madison Avenue, New York City.

CLIMAX Mo-lyb-den-um

A. F. A. Elects Six New Directors

ELECTION of six new directors of the American Foundrymen's association was announced at the recent convention and exhibition in Chicago. The following were elected for a three year term: George Batty, T. S. Hammond, R. F. Harrington, R. J. Teetor and J. L. Wick Jr. Dr. H. Ries was named for a one year term.

George Batty

GEORGE BATTY was born in England and received his technical education at the Sheffield Technical school, Sheffield university. For the next 11 years he was connected with a number of Sheffield firms as steelmaker or works manager, in the manufacture of tool and special steels. In 1920, he spent several months in the United States as consultant for the Ford Motor Co., Detroit, and then returned to England to become conected with the production of steel castings. He was appointed works manager of the National Steel Foundry Ltd., Leven, N. B., in 1923 and later became technical director of that company. In 1927-1928 he operated as steel foundry consultant at Detroit and then became director of the Steel Castings Development bureau, Philadelphia. Mr. Batty has been active in the affairs of the American Foundrymen's association, and has presented numerous papers dealing with various phases of steel castings production before conventions of that group.

Gen. T. S. Hammond

GEN T. S. HAMMOND, retiring president, was born at Crown Point, N. Y., Oct. 29, 1883. He received his preliminary education at Hyde Park high school, Chicago, and later attended the University of Michigan, Ann Arbor, Mich., from which he was graduated in 1906. In the following year he entered the employ of the Whiting Corp., Harvey, Ill., through which he advanced successively as purchasing agent, assistant secretary, vice president and secretary, vice president and treasurer, and finally president and general manager, his present position.

Mr. Hammond also is vice president of the National Engineering Co., Swenson Evaporator Co., Grindle Fuel Equipment Co., and the Joseph Harrington Co., all of Chicago. He has had a distinguished military career, first on the Mexican border in 1916, later overseas for 18 months in France, and now as Brigadier-General he commands the 65th infantry brigade, Illinois national guard.

Gen. Hammond is vice president, Illinois Manufacturers association and a member of the executive board of the Chicago chamber of commerce. He is past president, National Founders' association, Foundry Equipment Manufacturers association and the Chicago branch, National Metal Trades association.

Dr. H. Ries

DR. H. RIES was born in Brooklyn, N. Y., in 1871 and acquired his technical training at the Columbia School of Mines, New York, receiving degrees of M.A. and Ph.D. He is well known to the foundry industry, not only as head of the department of geology, Cornell university, Ithaca, N. Y., but also for his contribution to research work on molding sands. He is technical director of the A.F.A. committee on molding sand research, under which body he also serves as a member of the executive committee, chairman of the committee on tests and member of the subcommittee on rebonding clays.

Dr. Ries has published a number of papers on clays and molding sands, and has prepared numerous reports on sands for various state and national geologic surveys. He is author of several works, including *Economic Geology, Clays—Occurrence, Properties and Uses* and with T. L. Watson *Engineering Geology.*

He is a member of the A.F.A., American Institute of Mining and Metallurgical Engineers, Canadian Mining institute, American Ceramic society—of which he also is a past president, English Ceramic society and Geologic Society of America. He

(*Continued on Page* 44)

R. F. Harrington James L. Wick Jr. T. S. Hammond

George Batty H. Ries R. J. Teetor

SMALL INVESTMENTS

Can

MAKE BIG SAVINGS

TAKE the case of the eastern valve manufacturer for instance. Beset with low prices, fluctuating demand, small runs and keen competitive conditions, he was forced to make additional operating economies.

At our suggestion he installed a simple overhead conveyor for sand and a roller conveyor for molds. This modest installation..the total cost was less than a thousand dollars..paid for itself in four months. It is returning a monthly saving of $250.00 today.

Twenty years' experience in designing and building profit-making, profit-saving foundry equipment *does count.* It's at your disposal. These same experts will visit your plant, study your methods..check your costs. Their recommendations furnished with definite guarantees of performance will be peculiarly fitted to conditions in your plant. They will help solve your problems. There's no obligation. Write today.

A simple overhead hopper like this pays for itself in a short time.

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BARTLETT-SNOW

DESIGNERS AND MAKERS OF FOUNDRY EQUIPMENT

(*Continued from Page 42*)

is a past president and fellow of the latter organization, and also is a member and former chairman of the A.I.M.E. committee on nonmetallic minerals.

R. F. Harrington

R. F. HARRINGTON was born in Chicago in 1890, and was graduated from Tufts college in 1913 with a degree of bachelor of science in chemical engineering. Since 1913, he has been connected with the Hunt-Spiller Mfg. Corp. of Boston, first in charge of installing a works and research laboratory, then a chemist in charge of the laboratory and now chief metallurgist in charge of all technical foundry activities, metallurgical research and development.

Mr. Harrington has been active in the work of various associations representing the foundry industry. He is a past president of the New England Foundrymen's association; member of the A. F. A.; member of the executive committee, molding sand research and chairman of the committee on conservation and reclamation of molding sand; a member of the gray iron castings committee, gray iron division, A. F. A.; member of the A. I. M. E. executive committee of the iron and steel division; chairman of the cast iron foundry committee of the A. I. M. E.; member of the executive committee, Boston chapter of the American Society for Steel Treating and a member of the American Society for Testing Materials.

Maj. R. J. Teetor

MAJ. R. J. TEETOR was graduated from Purdue university in 1905 and immediately entered the employ of the Link-Belt Co., Indianapolis, where he attained the position of chief engineer. In 1915 he resigned to become associated with the Standard Malleable Iron Co., Muskegon, Mich., as secretary and general manager. A year later he organized the Howe Chain Co., Muskegon, and became vice president and general manager.

In March 1917 he resigned his connection with the Standard Malleable Iron Co. and the Howe Chain Co. to enter the officers' training camp at Fort Benjamin Harrison, Ind., from which he emerged with the rank of major and was assigned command of the second battalion 335th infantry. He served in France with that regiment for 5 months, returning to the United States as division inspector of the 83rd division in January, 1919.

After securing a release from the army he rejoined the Howe Chain Co and continued in his former capacity as vice president and general manager until 1921 when he became associated with interests in Cadillac, Mich. in the erection and operation of the Cadillac Malleable Iron Co. He has served as secretary and general manager of that company since its organization.

Maj. Teetor is a member of the malleable iron advisory committee of the American Foundrymen's association, a member of the board of the Malleable Iron Research institute, and is vice president of the Carson-Cadillac Corp.

James L. Wick

JAMES L. WICK, Jr. was born in Youngstown, O., Jan. 28, 1883. He was educated in the Rayen school at Youngstown and graduated from Massachusetts Institute of Technology, Boston, in 1906, with a degree of bachelor of science in mechanical engineering. He then joined the Youngstown Sheet & Tube Co. as assistant to the master mechanic and the following year was made assistant to the chief engineer. In 1908 he became general manager and secretary-treasurer of the Crystal Ice & Storage Co., Youngstown, serving in that capacity until 1917 when he became associated with the Realty Guarantee & Trust Co. During the war period, he acted as assistant fuel administrator for the Youngstown district and also served as special agent for the Youngstown Sheet & Tube Co.

Mr. Wick became connected with the Falcon Bronze Co. in 1919 as secretary and assistant general manager. In 1926 he was made vice president and general manager and in 1929 was elected president and general manager. He is a member of the A.F.A., American Iron & Steel institute and National Founders' association and has been active in the nonferrous branch of the American foundry industry.

Book Review

Permanently Curing Depressions, by M. H. Reymond, cloth, 128 pages, 5 x 7½ inches, published by the Baker & Taylor Co., New York, and supplied by THE FOUNDRY, Cleveland, for $2, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

Sacrifice of the gold standard to a new monetary principle is the suggestion of the author for providing a permanent cure for the radical changes in the economic cycle. One element in this new monetary principle would change the character of outstanding currency of the United States from gold to non interest bearing bonds of the United States. Currency, as non interest bearing debt, would become a direct obligation of the government. Interest bearing debt in the form of bonds and non interest bearing debt in the form of currency would be pooled under one head as outstanding obligation of the government. The author answers the argument that this would constitute fiat currency, and describes how the expansion and contraction of currency would be strictly a mechanical operation.

Measures Hardness Of Metals with Pendulum

Research engineers of the Westinghouse Electric & Mfg. Co., East Pittsburgh, determine the hardness of beryllium with a Herbert pendulum. The pendulum hardness tester is also used with thin sheets of metal, very brittle metals, case-hardened metals or other materials that cannot stand the rigors of hardness testing by the brinell or scleroscope methods.

A tiny spherical steel ball, 1/25-inch in diameter, supports the heavy pendulum upon the test specimen.

A tiny spherical steel ball supports the heavy pendulum

The spherical ball sinks farther into soft metals than hard metals, lessening the amount of swing but increasing the time required for it. An air bubble in the curved tube on top of the pendulum indicates on the scale above the tube the extent of the pendulum's swing, and from this data the specimen's hardness is computed.

Names Representative

American Monorail Co., 13107 Athens avenue, Cleveland, recently has appointed several sales agents including the following: McVoy-Hausman Co., Birmingham, Ala., in the state of Alabama; D. S. Mair Machinery Corp., 505 Esperson building, Houston, Tex., in the state of Texas; T. Spenser Williamson, Mutual building, Richmond, Va., in the state of Virginia and the United Machinery Co., 289 East Salmon street, Portland, Oreg., in the Oregon territory.

The second golf tournament of the season was staged by the Detroit Foundrymen's association, Thursday, June 15, at the Maple Lane Golf and Country Club, near Detroit.

TAMASTONE *Stops the* SHOW!

The photograph above shows a partial view of the crowds constantly watching the making of "Tamastone" Pattern Plates at the Foundryman's Convention in Chicago. We apologize to the exhibitors near us and at the same time thank them for their most courteous accommodation of the crowds unable to stand within our booth to watch the pouring of various "Tamastone" patterns.

Tamastone, The Perfect Pattern Compound, is truly an innovation and we ask that you do not let any previous experience with pattern compounds form your opinion of "Tamastone".

Tamastone is a compound which comes to you in dry powder form and needs only mixing with water and the following of simple instructions to enable you to make *perfect* patterns right from the start.

Tamastone is used to make Match Plates — Squeezer Plates — Roll-Overs — Pattern Duplicates — Cope and Drag Patterns and Core Boxes.

Tamastone pours freely and flows into the finest detail of molds. It drys in one hour and *there is no shrinkage*. Molds can be made within ninety minutes after pouring if necessary. Best results obtained by drying over night.

Tamastone patterns require no sanding or scraping and for cleaning require only water and a soft brush.

We request the privilege of furnishing you with a sample of "Tamastone" and have our representative demonstrate its efficiency on your own work and with your own patterns.

Match Plate made during show from a number of small loose patterns. Time required one hour and a half. Total cost less than $3 for material and labor.

TAMMS SILICA CO.

FOUNDRY DIVISION

228 N. LaSalle Street CHICAGO, ILLINOIS

Convention Leads in Recovery

(*Continued from page 20*)

ture which was made at Purdue under his direction to illustrate molding and coremaking methods. R. S. Hammond, Whiting Corp., Harvey, Ill., agreed with the previous comment regarding plant visitations, and mentioned the availability of a diagram showing in detail the operation of a cupola.

H. F. Campbell, University of Michigan, Ann Arbor, Mich., believes that it may be necessary for engineering schools to be the aggressor in making contacts and this may be accomplished best through research in which industry is interested. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., deplored the lack of training in the fundamentals of personnel relationships. Numerous others discussed the ideas presented.

Accept Committee Report

The conference voted to accept the report of the joint committee on foundry education in engineering schools and to thank the committee and sub-committee in charge of preparation for the work accomplished.

A. B. Pierce, director, department of industrial education, National Metal Trades association, Chicago, directed the conference on apprentice training Friday under the chairmanship of John Ploehn, French & Hecht, Inc., Davenport, Ia. The movement lying dormant for the past few years owing to industrial conditions, again is becoming a live issue and is bound to become more acute as industry hits its stride and realizes the need of skilled help either as mechanics or in supervising capacity. Discussion of the many angles of the question culminated in a resolution to have the apprentice training committee co-operate with other groups in formulating guidance codes in line with the National Industrial Recovery act.

A joint conference, with representatives of the American Foundrymen's association, Steel Founders' Society of America, Gray Iron institute, and Malleable Iron Research institute, with a number of representatives of leading power companies held Monday afternoon, developed a great range of inequalities in power rates throughout the country. A survey made of steel and iron foundries, steel mills and brass foundries comprising 130 different localities throughout the country demonstrated that there is no basic uniformity in rate structures. The principal contention of users during the depression period has been that demand charges imposed a burden inconsistent with the times and a penalty upon manufacturers using electric melting equipment. In some cases the percentage of the total electric bill represented by demand charge has ranged as high as 74 per cent. In terms of percentage of selling price of castings this charge has varied from 3.3 to 38 per cent.

Representatives of power interests explained the demand charge as being based upon considerations similar to an overhead structure established by any manufacturer. This interpretation was contested by foundry representatives and a number of inequalities were stressed in which it was shown that the demand charge did not in any way reflect a charge upon investment or even appraised valuation, but seemed rather to be a penalty clause. The practice of applying the demand charge as a percentage of the previous month's account was depreciated and it was pointed out that no credit applied against this demand charge in cases where conditions were favorable to users of current.

J. R. Allan, International Harvester Co., Chicago, chairman of the meeting, urged that long term contracts running over a period of 5 to 10 years should be avoided. He recommended a period of from 1 to 3 years, with a 30-day cancellation clause. The survey showed that the average cost per kilowatt hour per average load is 0.0103.

Quotation Showed Variation

The representative of a large foundry interest in northern Indiana quoted a comparison made in 1929 with a demand of 1456 kilowatts and energy of 6200 showing variation in various districts. With 79.7 power factor, a bill was figured which showed in Detroit $2884 demand charge against a total billing of $7846. In northern Indiana, the demand charge was $1669, in Pittsburgh $927.50 and in Wheeling, W. Va., $3375. A similar disparity in about the same relation was shown in 1932. At that time the power cost of $32.50 per ton was figured against steel castings sold at about $120 a ton.

The committee was directed by the conference to carry on with its investigation and in co-operation with power producers to endeavor to secure some more favorable consideration.

Study Iron Melting Practice

PROBLEMS relating to melting in the electric furnace, air furnace and cupola were considered at the session on cast iron on Wednesday, which was presided over by John W. Bolton, Lunkenheimer Co., Cincinnati, with Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., as vice chairman. C. R. Culling, Carondelet Foundry Co., St. Louis, in a paper "Experience of a Gray Iron Jobbing Foundry with the Rocking-Type Electric Furnace," showed that increased strength, increased density as desired and improved machinability were possible with that type of melting medium.

H. Bornstein, Deere & Co., Moline, Ill., and H. S. Austin, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. both commented on the exceedingly small variation in the carbon content of a series of irons reported in the paper. Mr. Culling stated that the charges consist of steel scrap and cast iron borings and that care is taken to standardize each car or shipment of borings. Mr. Bolton commented on the absolute necessity for the most rigid technical control in foundry practice today. Mr. Culling, in response to a question, stated that the cost of current is considerably higher than coke, but this is offset partially by the use of cheaper materials and that the final cost is comparable with the best grade of cupola operation.

D. P. Forbes, Gunite Corp., Rockford, Ill., presented a paper on "Air Furnace Cast Iron," in which he stated that important factors in this method of melting include the design of the furnace, selection of raw materials, adherence to a definite program, and the employment of a skilled operator. He stated that it was desirable to have the cupola used in duplexing as near the air furnace as possible.

Adds Fused Soda Ash

His company uses a spout direct from the cupola to the furnace, with a small receiver between in which fused soda ash is added. This arrangement permits use of the air furnace for either batch or continuous pouring. A 15-ton heat usually is ready for pouring 6¾ hours after the furnace is lighted and the furnace is empty in 7½ hours after lighting. Mention also was made of the use of various alloys in air furnace iron.

The discussion brought out the fact that the longer melting time required in this process eliminates the necessity for superheating. In reply to a question as to what constitutes superheat, Mr. Forbes stated that the iron was poured between 2700 and 2900 degrees Fahr. John Shaw, an English visitor at the convention, stated that superheating is not of advantage, but rather is detrimental

in irons of less than 3 per cent carbon.

A paper "Effects of Slag on Cupola Operation and Metal Structure," by R. H. Bancroft and A. C. Meyers, Perfect Circle Co., Newcastle, Ind., reported the results of a series of tests in which the flux consisted of all limestone, all dolomite and a mixture of dolomite and limestone. This investigation has led the company to standardize on a flux consisting of 62 per cent dolomite, 22 per cent limestone and 16 per cent fluorspar. J. D. Stoddard, Detroit Testing Laboratories, Detroit, questioned the use of the same amount of flux in each of the three different tests, and stated that it would be necessary to increase the limestone content to secure the proper fluidity. Mr. Myers stated that his company had made experiments with various percentages of limestone, and it was found that point was reached where increasing the limestone did not increase the fluidity. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., stated that he has found small sizes of stone, if properly cleaned, will give better results than larger sizes.

Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., presented a paper prepared by C. L. Frear, DeLaval Separator Co., Poughkeepsie, N. Y., and entitled, "Practical Experiences with Electric Furnace Iron." The paper describes a method of melting gray cast iron in the direct arc electric furnace and shows the operations desirable or necessary to produce soft, easily machined but close grained castings, even using a very large amount of steel and cast iron scrap, including chips and borings and a corresponding small amount of pig iron in the charge.

Technical phases of gray iron foundry practice were discussed at the session on cast iron on Thursday, with James T. MacKenzie chairman, and R. S. MacPherran, Allis-Chalmers, Mfg. Co., Milwaukee, as vice chairman. A paper, "Properties of Gray Cast Iron as Affected by Casting Conditions," by C. M. Saeger Jr. and E. J. Ash, bureau of standards, Washington, discussed various factors including the effect of superheat on the strength of cast iron as shown by test bars. The authors reported that irons of high carbon content are effected more by superheat than are low carbon irons.

The second paper, prepared by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y., was entitled "Titanium in Cast Iron." The author records the results of four tests, one on cupola metal and three on electric furnace iron and points to the availability of titanium and chromium in making high test cast iron. A paper entitled "Silal and Nicrosilal Heat Resisting Cast Irons" by A. L. Norbury and E. Morgan, Birmingham, England, was read by J. S. Vanick, International Nickel Co., New York. The contribution records a general account of the properties of two cast irons recently developed by the British Cast Iron Research association. John Shaw of England offered several comments on the irons, pointing out that while the composition may be right, the material possibly will fail if the structure is not correct.

Graphite Must Be Low

The French exchange paper, "Martensitic Quenching of Cast Iron," by G. R. Delbart, Ateliers des Anciens Etablissements Cail, Denain, France, was presented by H. Bornstein, Deere & Co., Moline, Ill. To secure the best results in martensitic quenching, the graphite should be as low as possible, the graphite should be fine and round in shape, the chemical composition must be correct and quenching must be accomplished at the lowest possible temperature. The author also discussed the effect of silicon, magnesium and nickel pointing out that magnesium over 2 per cent favors that type of treatment.

The final paper of the session was theoretical discussion on "Silicon and Manganese as Deoxidizers in Cast Iron," by A. H. Dierker, Ohio State University, Columbus, O.

The final technical session on cast iron was devoted to cast iron tests and specifications, and was a joint meeting of the American Foundrymen's association and the American Society of Testing Materials. H. Bornstein, chairman, presented a brief outline of the relationship of the A. S. T. M. and the A. F. A. in the development of tests and specifications, and the significance of testing cast iron and limitations of testing. R. S. MacPherran, spoke on various tests for cast iron, and the correlation of test bar and casting.

Factors in the mechanism of testing were described by J. T. MacKenzie, who also presented information on the production of test bars. A. L. Boegehold, General Motors Research Laboratories, Detroit, prepared a paper on "Wear Tests and Value of Hardness Testing for Control of Product," which was abstracted by R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, Mass. The final paper relating to A. S. T. M. specification A48-32T for cast iron was presented

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F. J. Lanahan Elected President

FRANK J. LANAHAN, elected president of the American Foundrymen's association is a native of Pittsburgh where he has lived continuously and where most of his long list of business activities and connections are located. He was educated at Grant public school, Pittsburgh high school, Pittsburgh and St. Mary's Academy, Blairsville, Pa.

Mr. Lanahan is president, Fort Pitt Malleable Iron Co., Pittsburgh; president, Davis Brake Beam Co., Johnstown, Pa.; president, Auto Tite Joints Co., Pittsburgh; Fort Pitt Mine Equipment Co., Jeanette, Pa.; president, McKees Rocks Trust Co., McKees Rocks, Pa.; director Warren Foundry & Pipe Corp., Phillipsburg, N. J.; vice president, Chartiers Trust Co., McKees Rocks, Pa.; vice president, Pennsylvania chamber of commerce, Harrisburg, Pa.; member of the boards of directors of National Safety Council, Railway Business association on New York and the Western Pennsylvania Safety Council, Pittsburgh, and chairman of the executive committee and director of the Railway club, Pittsburgh. He is a member of the American Iron & Steel institute, Western Pennsylvania Engineers society, American Society of Safety Engineers, American Society of Municipal Engineers.

During the war period Mr. Lanahan was chairman of the malleable iron industry war service committee. He was secretary of the Pittsburgh chapter American Red Cross, chairman of the entertainment committee and chairman of the motor corps and transportation committee, chairman of the united war work campaign committee and the Red Cross war work campaign committee.

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Pittsburgh, Pa.

(*Continued from page 47*)

by John W. Bolton. The various papers were discussed briefly by W. W. Kerlin, Gray Iron institute, Cleveland, William J. Grede, Liberty Foundry Co., Wauwatosa, Wis., J. W. Bolton, J. T. MacKenzie and R. F. Harrington.

Probe Nonferrous Problems

APPROXIMATELY 60 members of the association attended the opening nonferrous session held Wednesday morning. Sam Tour, Lucius Pitkin Inc., New York, and Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa., were chairman and vice chairman respectively. H. J. Roast, McGill university, Montreal, opened the meeting by presenting some data on the effects of phosphorus, aluminum and silicon on leaded bronze containing 7 to 8 per cent tin, 15 to 21 per cent lead, 2 per cent zinc, and remainder copper. The test data indicated that aluminum and silicon must be kept out of the alloy to obtain best results. H. M. St. John, Detroit Lubricator Co., Detroit, in discussing the paper said results obtained were similar to an investigation which he and several others conducted a few years ago on an entirely different alloy. Mr. Tour, G. H. Clamer, Ajax Metal Co., Philadelphia, and E. F. Hess, Ohio Injector Co., Wadsworth, O., also discussed the paper.

C. S. Cole, Copper & Brass Research association, New York, presented an abstract of a paper prepared by himself and O. E. Harder, Battelle Memorial institute, Columbus, O., on an investigation of six bearing bronzes. Data were presented on the tensile and yield strengths, elongation, reduction of area, hardness and resistance to pounding. Attention was called to the fact that strength obtained was considerably higher than is called for in the standard specifications for the several alloys tested. Discussion of the paper by G. H. Clamer and Mr. Hunkey, Federal-Mogul Corp., Detroit, developed the information that steelback babbitted bearings were used on the basis of price considerations and higher strength, but that steelback bronze bearings were gaining ground.

New Alloying Agent

A paper on beryllium-copper castings by E. F. Cone, New York, was presented in abstract by Mr. Reilly, Beryllium Development Corp., New York. He said that use of beryllium in copper as an alloying agent was comparatively new, and that considerable investigation still was necessary to ascertain all its possibilities. Beryllium-copper alloys in commercial castings contain from 1.5 to 2.5 per cent, and the most desirable results are obtained with heat treatment.

A lively discussion of causes of defective castings followed the nonferrous luncheon on Wednesday. Chairman H. M. St. John, opened the meeting by describing the foundry laboratory operated in connection with plant practice by his firm. The laboratory contains a small electric and gas-fired furnaces, and a stock of ingot and virgin metals known to be satisfactory. When trouble occurs those metals are used with constituents of the shop charges so that only one variable is changed at a time. In due course, the cause of the trouble usually is found and corrections made in shop metal charges or foundry practice.

One of the subjects discussed was the causes of dirt porosity. One member stated that in his experience he found that much of the trouble from that source could be corrected by attention to gating and by employing pouring temperatures as low as possible. Another said that molding sand should be riddled through a fine sieve every 3 or 4 months to remove any tramp metal, pieces of cores, etc. Pots of metal should be skimmed thoroughly before pouring and pyrometers employed to insure correct temperatures. Choke gates, when the sprues are kept filled, will to a large degree give clean castings. Soft cores may be the cause of dirty spots, and attention should be given to that feature.

In discussing gas porosity, it was pointed out that hydrocarbons such as oil on the metal, rather than a reducing atmosphere in the furnace, were the agents causing gas porosity.

Dan M. Avey Is Made Vice President

Photo Bachrach

DAN M. AVEY, new vice president of the American Foundrymen's association, was born in Charleston, Ill. on May 3, 1888. He was educated in the public schools and high school, Mattoon, Ill., and was graduated with a degree of bachelor of science in civil engineering from the University of Illinois, Urbana, Ill., in 1910. Previous to entering the university, he was employed as rodman and transitman with the D. S. & M. Transit Co., and Big Four railway maintenance of way department. Later he was assistant city engineer, Mattoon, Ill. In 1910 he became associate editor, Municipal Engineering, Indianapolis, and a year later resigned to become connected with the Engineering Experiment station, University of Illinois, as assistant to the director, where he had charge of publications. From 1912 to 1917 he was assistant cashier, Central Illinois Trust & Savings bank Mattoon.

In 1917 he first became connected with the Penton Publishing Co., Cleveland, as associate editor of Iron Trade Review, now Steel. Later he was given certain editorial duties in connection with The Foundry, and in 1919 he was made managing editor of this Publication. In 1926 he was made editor of The Foundry, the position he now holds. He also is a director of the Penton company.

Mr. Avey has been active in furthering the interests of the various organizations affiliated with the foundry industry. He is a member of the American Foundrymen's association, the American Society for Testing Materials, and the International Association of Testing Materials. He has served 2 years as director and member of the executive committee of the American Foundrymen's association, is chairman of the international relations committee, chairman of the program and papers committee, a member of the committee to co-operate with the New York museum of science and industry, a member of the divisional activities correlation committee, and a member of the joint committee with the A. S. T .M. on the cast iron symposium which was presented at the 1933 A. S. T. M. convention in Chicago.

Consequently, it is advisable to burn off the oil before melting to eliminate the trouble. One member stated his practice was to dry the borings or chips to eliminate the oil. The cost was about ⅛-cent a pound, but that it was more than offset through reduced kilowatt consumption in the electric furnace. Attention was called to the fact that if molten metal was poured over charcoal that gas porosity would ensue, but that no trouble occured when charcoal only was placed on the surface as a protective agent. Mention was made of the advisability of removing the fine material from used molding sand to prevent reduction of permeability.

Hold Bronze Symposium

A change in the usual form of nonferrous technical sessions occured at the second meeting on that subject held Thursday morning. Instead of having several papers presented, the meeting was arranged as a symposium on the degasification and deoxidation of bronze foundry alloys with the subject divided into three groups or divisions covering as many specific alloys. T. E. Kihlgren, International Nickel Co., New York, was chairman of the meeting and was assisted by C. H. Lorig, Battelle Memorial institute, Columbus. John W. Bolton, Lunkenheimer Co., Cincinnati, the first speaker, spoke on deoxidation of valve bronzes of the 85-5-5-5 type, and said that use of heavier gates and a neutral atmosphere in the furnace eliminated difficulties, and permitted a greater pouring range.

R. A. Binney, Binney Castings Co., Toledo, O., H. M. St. John, Sam Tour, W. E. Paulson, Thos. Paulson & Son Inc., Brooklyn, N. Y., and H. W. Maack, Crane Co., Chicago, discussed the problem, and it was stated that oxidized metal was that which was sluggish, that a carbon monoxide atmosphere practically has no effect on the metal, and that it hardly was possible for oxygen as an element to be in a copper-base alloy. It also was mentioned that only enough phosphorus should be employed to deoxidize the metal as an excess was detrimental, and that copper oxide dissolved in the metal and nonmetallic inclusions were the causes of trouble rather than oxygen as such.

The second division, tin bronzes of the 88-11 type, was treated by O. W. Ellis, who presented an abstract of his paper on "The Mechanism of Inverse Segregation." Mr. Ellis developed a theory that the metal in freezing formed a series of minute capillaries through which the tin-rich component arrived at the surface of the metal. G. H. Clamer, in the discussion said that he agreed with Mr. Ellis' theory, and that by limiting various impurities that tin-sweat would be eliminated. E. F. Hess, stated that in making a casting of a similar alloy that he found it necessary to balance the phosphorus content as above and below a certain point tin-sweating occured.

Degasification and deoxidation of leaded bearing bronzes of the 80-10-10 type was described briefly by G. H. Clamer who said that the alloy was affected similarly to the other two alloys discussed, and that the same precautions must be taken. O. W. Ellis said that in some experiments he conducted some time ago that he could find no difference in oxide content whether the metal was poured as soon as possible after melting or held under heat for a long period. However, the cooling rate of the metal affected the size of the zinc oxide particles; smaller particles being obtained with rapid cooling. Various points of deoxidation and degasification were described in a written discussion by Mr. Barker, Federated Metals Corp.

Alloys in Steel Castings

EFFECTS of alloys on steel castings were discussed in four comprehensive papers presented Wednesday morning at the symposium on steel castings under the chairmanship of R. A. Bull, Electric Steel Founder's Research group, Chicago, assisted by W. C. Hamilton, American Steel Foundries, East Chicago, Ind., as vice chairman.

Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa. described the effects of vanadium. J. H. Critchett, Union Carbide & Carbon Research Laboratories Inc., New York discussed the effects of chromium. H. W. Gillett co-author with J. L. Gregg, Battelle Memorial Institute, Columbus, O., spoke on molybdenum: and the application and effects of nickel engaged the attention of A. G. Zima International Nickel Co., New York. The various papers were illustrated liberally with tables, charts and reproductions of micrographs.

The scope of the vanadium paper may be inferred from the following list of topics discussed: Influence of vanadium on the *as cast* condition, response to simple heat treatment, carbon-vanadium steels, nickel-vanadium steels, chromium-vanadium steels, manganese-vanadium construction steels, some special vanadium steels, annealed castings, quenched and tempered castings, molybdenum-vanadium steel for centrifugally cast guns, behavior of steels as heavy castings, properties at subnormal temperatures, properties at elevated temperatures, cast tool steels, applications for corrosion and heat resistance.

The chromium paper dealt in succession with castings containing 1 to 3 per cent chromium used for structural parts, castings containing from 4 to 7 per cent used where both structural and certain corrosion problems must be met, and special high chromium corrosion resistant steels.

According to the authors of the paper on molybdenum, a considerable quantity of that alloy is required in a straight carbon-molybdenum steel to produce a high strength product comparable by the conventional physical tests to some other fairly low alloy steels. On account of the cost, the plain molybdenum steels ordinarily are not used where static figures alone determine their suitability. However, many of the inherent properties conferred on steel by molybdenum are shown as the result of the addition of quite small amounts with great static improvement if used in conjunction with other alloys.

Molybdenum Is Effective

The readiness with which molybdenum fits in with other alloying elements to produce steels high in physical properties when quenched and tempered, the added ease and certainty in hardening throughout in quenching produced by molybdenum and the ability to remove casting strains by a high temperature draw without softening castings too much, make the element a good friend alike to steel foundrymen and to the user of steel castings.

A comprehensive presentation of typical nickel steels with some of the uses to which they are applied appeared under the following heads in A. G. Zima's paper "Properties and Uses of Some Cast Nickel Alloy Steels:" Low carbon 2.00 per cent nickel steel, medium carbon 2.00 per cent nickel steel, pearlitic nickel-manganese steels, nickel-chromium steels, some special nickel-chromium steels, nickel-vanadium steels, nickel-molybdenum and nickel-chromium-molybdenum steels, abrasion resistant castings, austenitic nickel-manganese steels, castings for elevated temperature service.

A particularly illuminating table with reference numbers indicating specific sections in the text covered the following features on an almost infinite variety of castings: Requirements, typical applications, type composition of steel. For example: Superior mechanical properties in normalized steel castings, light and medium sections; oil well tools, sheaves, sprockets tractor shoes, gears, cams, etc.; nickel-chromium steel, carbon 0.30-0.40 per cent,

(*Continued on page 52*)

MOORE RAPID Lectromelt FURNACES

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SOME ADVANTAGES OF THE LECTROMELT PROCESS FOR MAKING HIGHEST QUALITY IRON AND STEEL CASTINGS

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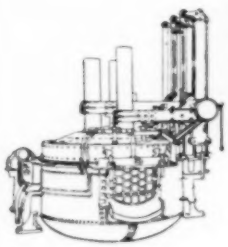

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(*Continued from Page 50*)

nickel 1.25-1.50 per cent, chromium 0.70-0.90 per cent, manganese 0.60-0.90 per cent.

A detailed description of the installation, constructional features and operation of a coreless induction furnace in the laboratory of the General Electric Co., Schenectady, N. Y., prepared by W. E. McKibben was presented at the steel round table meeting Wednesday afternoon by M. Meyer. On 170-pound scrap charges the kilowatt-hour-cost is about 850 per ton and the time for a heat about 1¼ hours. The meeting was presided over by P. E. McKinney, Bethlehem Steel Co., Bethlehem, Pa., with F. A. Melmoth, Detroit Steel Casting Co. Detroit, serving as vice chairman.

W. C. Hamilton, reported progress in submitting the report of the committee on specifications for alloy castings. Ballots now are in the hands of various members of the committee.

F. A. Melmoth outlined activities of various committees with which he is connected and referred to the wide variety of steels in existence. He defended his views on a previous occasion touching on the advisability of appointing a publicity committee under the auspices of the American Foundrymens association whose duty it would be to refute propaganda issued by competitive interests decrying the value of steel castings. In the speaker's opinion this committee could render valuable service to the industry by presenting papers at engineer's meetings and functions of a similar character.

In presenting his report of the committee on classifications of steel for castings R. A. Bull, stated the work is well in hand and that the committee favored the inclusion of the material in the *Cast Metals Handbook* to be issued by the American Foundrymens association.

Tentatively, steels have been divided into 10 main classifications and a proposed system contemplates a double word reference to indicate —if necessary—the alloy and physical properties of any given classification.

Report of the joint committee on effects of phosphorus and sulphur in steel indicated that phosphorus reduces tensile strength, but that the deleterious effects of sulphur have been over emphasized.

Interesting features in connection with the value of the impact test, hot tears in steel castings and the advantages of radiographic inspection precipitated an extensive and animated discussion at the steel founding session under the joint chairmanship of F. A. Lorenz Jr., American Steel Foundries Chicago and George Batty, Steel Castings Development bureau, Philadelphia, on Thursday.

Formal papers presented in the following order included: "Dynamic Properties of Steel Castings as Determined by Impact Test" by Fred Grotts, Continental Roll & Steel Foundry Co., East Chicago, Ind.; "Studies on Solidification and Contraction and Their Relation To Formation of Hot Tears in Steel Castings" by C. W. Briggs and R. A. Gezelius, Naval Research Laboratory, Bellevue, Anacostia, D. C.; "Advantages to Foundrymen of Radiographic Inspection" by H. R. Isenburger, St. John X-ray Corp., New York.

F. A. Lorenz Jr., American Steel Foundries, Chicago

Difference of opinion on several features of the first paper was expressed by D. Zuege, Sivyer Steel Castings Co., Milwaukee. Great care must be exercised in drawing conclusions from the impact test, presenting as it does many opportunities for falling into error. A great many factors must be taken into consideration and then corelated before arriving at a decision. Referring to the author's method of imparting dynamic properties, he favored a double anneal and draw.

R. A. Bull directed attention to the fact that a loaded car coming out of the furnace acquired different temperatures at the outside and at the center. He also referred to the extreme care required in taking either the Charpy or Izod test. The slightest innacuracy in the groove is magnified in the conclusions.

Herbert H. Blosjo, Minneapolis Electric Steel Castings Co. Minneapolis, Minn., discussed some of his experiences in testing steels and claimed that a good anneal gives best results in castings subject to impact test. He also has found that results of various forms of test bear an approximately definite relationship to each other.

A. W. Lorenz, Bucyrus-Erie Co., Milwaukee favored a movement to standardize the notch sizes for purpose of intelligent comparison. He has no confidence on tests taken from small bars and quoted experiences at the Watertown Arsenal to bear out his contention. Tests taken on large bars are satisfactory.

Replying to the various points, the author admitted that great care is required in the rapid normalizing method he advocated. Further his paper dealt with specific types of castings in which dynamic properties are desirable. He does not favor incorporating the impact test in specifications for other types of castings.

Written discussion was submitted by A. W. Lorenz, R. A. Bull, George Batty, and F. E. Melmoth, disputing some of the points raised and conclusions drawn in the paper presented by C. W. Briggs. Mr. Melmoth claimed that the designer more than any other person is responsible for hot tears in castings. Every foundryman is familiar with the necessity of providing collapsible features in molds and cores. His constant problem is how to maintain a balance between complete collapsibility and a mold that will resist the pressure of the molten metal.

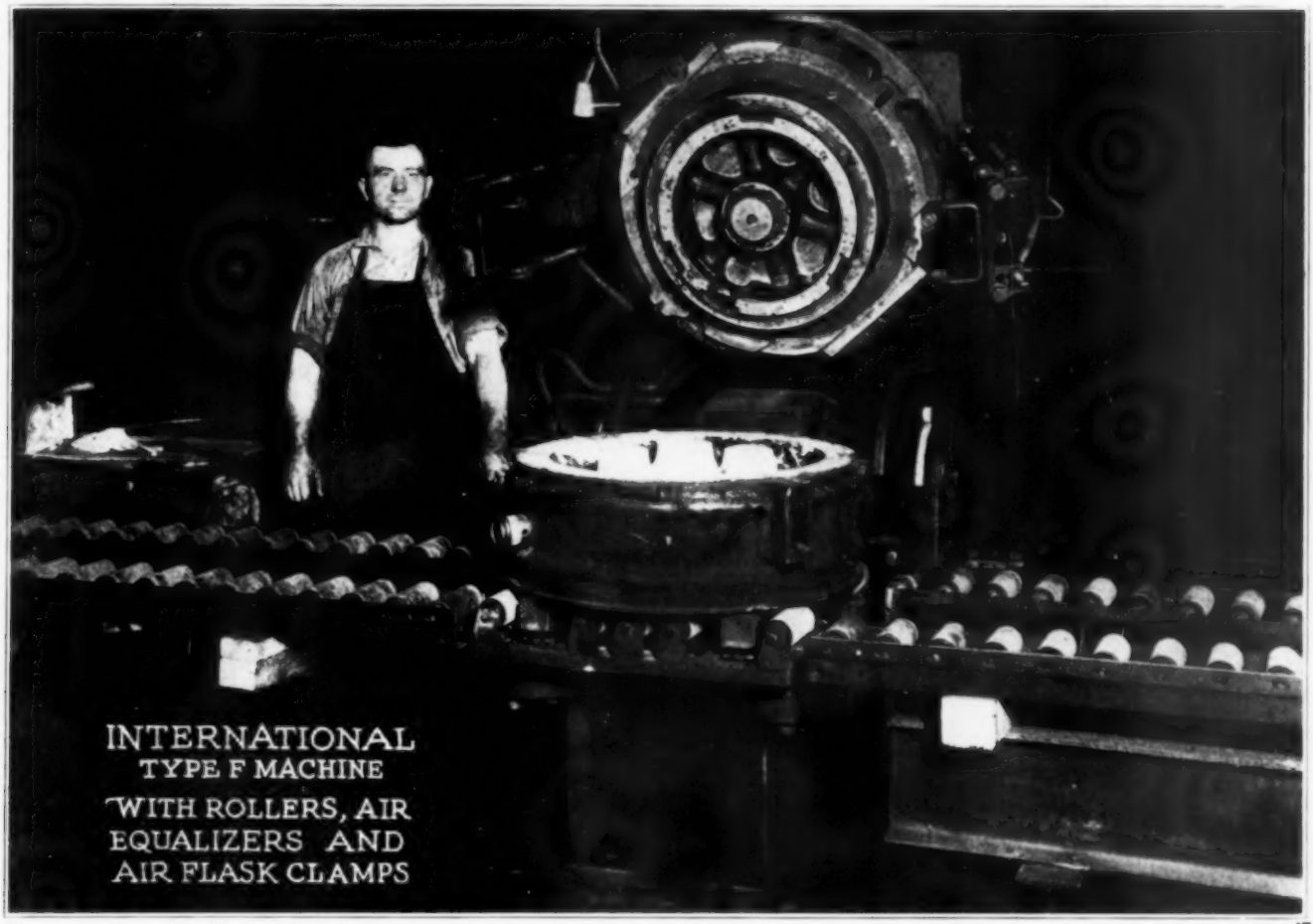
Good Foundry Housekeeping

GOOD housekeeping, a new topic for discussion on A. F. A. programs, but a subject which has received considerable attention in many foundries during the past year, attracted a large attendance of interested foundrymen at the session on Thursday afternoon. The meeting, a joint effort of the A. F. A. and the National Founders association, was devoted to the presentation and discussion of three papers under the chairmanship of S. Wells Utley, Detroit Steel Casting Co., Detroit, and president of the N. F. A.

Dr. E. G. Meiter, Employers Mutual Liability Insurance Co., Milwaukee, presented a paper on "The Dust Problem in the Foundry Industry" in which he outlined various factors which must be taken into consideration in any program of good housekeeping in the foundry. He also described the operation of equipment which has been developed to take dust samples and make a count of the dust particles in the air. The samples are taken at the breathing level of the worker at the particular point where the test is to be made, and a certain advantage results in taking the sample over a long period.

A thorough house cleaning is the

(*Continued on Page 54*)



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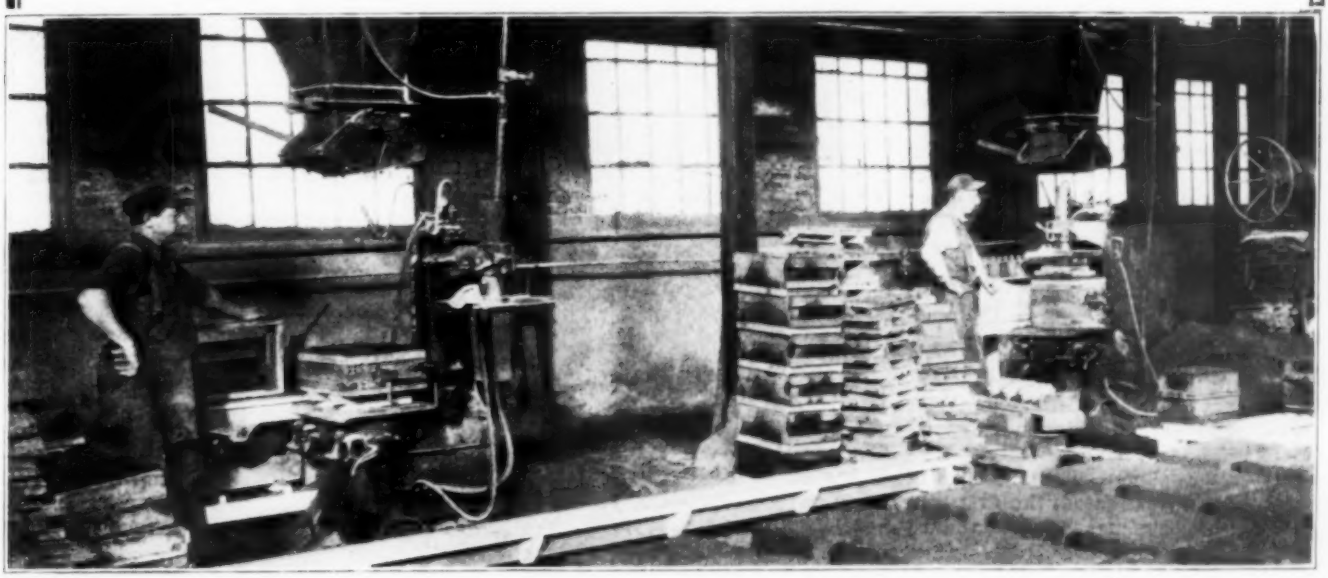

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first step in any program of dust elimination. Continuous vibration causes fine dust to fall from rafters and beams and therefore such accumulation must be removed and all other places where dust may accumulate must be cleaned. Several methods have been tried in different foundries including the following: Use of water under pressure; blowing off with compressed air, which removes the dust but scatters it throughout the shop and some again will settle on the places being cleaned; brushing; vacuum cleaning a combination of air and water; sandblasting and then painting; and steam.

Following the house cleaning, it is necessary to eliminate as much dust as possible at the source. In this, studies have shown that much progress can be made with the equipment on hand. The program should include the following steps: Good housekeeping; elimination of bad practices; proper maintenance of equipment and keeping it in air tight condition; proper maintenance of dust collecting equipment; isolation of dusty processes as much as possible; ventilation of certain operations which previously have not been considered dusty; and supplying workers exposed to dust which otherwise cannot be controlled, with proper helmets and respirators.

"Legal Aspects and Employer Responsibility" was the subject of a paper presented by Alfred C. Hirth, Williams Eversman & Morgan, Toledo, O. A. D. Lynch, personnel director, Ohio Brass Co., Mansfield, O., drew on his personal experiences for interesting information presented in a paper "Enlistment of Foreman and Worker Interest in Keeping a Clean and Orderly Foundry."

Malleable Foundry Practice

SIX papers were presented at the two malleable sessions Wednesday, one of which consisted of a luncheon and also included a round-table discussion. At the first meeting, presided over by Fred L. Wolf, Ohio Brass Co., Mansfield, O., a paper prepared by Rebecca Hall, metallurgist, Chicago, on "High-Strength Wear-Resistant Malleable Iron," was given by E. K. Smith, Electro-Metallurgical Sales Co., Chicago. In an attempt to develop a wear-resistant malleable iron, the author experimented with the effect of chromium additions plus silicon control.

The product sought was a casting of high strength, moderate ductility and considerable resistance to nonlubricated abrasion. The regular anneal was given to the castings which were made by ladle additions to standard metal. These additions ranged from 0.25 to 1.15 per cent, with the silicon varying from 1.02 to 2.02 per cent. Chromium of 0.84 per cent, with 1.57 per cent silicon, was found to give the maximum tensile strength. Elongations decreased and hardness increased with higher chromium contents. Elastic limits rose up to 62,500 pounds per square inch.

Possibilities of reducing the time necessary for the production of malleable iron were pointed out in a paper on "Effect of Superheat on Annealing of Malleable Iron," by A. E. White and R. Schneidewind, department of engineering research, University of Michigan. Three groups of irons were investigated, the first consisting of specimens of standard foundry composition, the second and third being made in a rocking-arc electric furnace of low carbon and low silicon type. Superheat temperatures ranged up to 2970 degrees Fahr. for the commercial irons and up to 3180 degrees for the electric furnace irons. It was the authors' conclusion that superheating coupled with good furnace design are capable of reducing normal malleableizing cycles up to 50 per cent.

Sand control practice of the Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., was described by Charles Morrison, assistant metallurgist. This foundry has continuous molding and sand handling equipment and uses all facing sand. Methods of handling the sand, adding of moisture and bond and use of sea coal were discussed. Sea coal is ground to pass 99 per cent through a 70-mesh screen. For large work 11 to 12 per cent sea coal is carried in the sand, and for small work 9 to 10 per cent is carried. The author pointed out that the finish on a casting is no better than that produced by the coarsest particle in the sand. Vibrating screens remove large particles so that about 95 per cent of the sand will pass a 40-mesh screen. Control of core sand was regarded as of equal importance as control of molding sand.

W. E. Paulson, Thos. Paulson & Sons Inc., Brooklyn, N. Y.

Following the luncheon Dr. H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland, spoke on "Some Anomalies in Annealing." This session had J. H. Lansing, Danville Malleable Iron divison, Allith-Prouty Co., Danville, Ill., as its chairman. Dr. Schwartz described how various contradictory and diverse opinions regarding factors relating to malleable iron production have arisen. High-temperature properties of malleable iron were discussed by H. W. Maack, Crane Co., Chicago. Considerable comment on the subject of pouring temperatures followed a paper on "Cracks and Pouring Temperatures," by E. M. Handley, Chain Belt Co., Milwaukee. The author described how cracks were eliminated from certain castings by a moderate reduction in pouring temperature. While these results were substantiated by experiences of others proper temperatures were found to vary according to type of castings and composition of the metal.

Brief discussions also were held on several other subjects relating to malleable iron following the presentation of these papers.

The extensive character of the technical sessions, shop courses, and group meetings at the Chicago convention makes it impossible to present all of the complete and detailed reports in this issue. Reports on sand and iron shop courses, and sessions on materials handling, sand and refractories will be presented in the August issue.

The Editors

The bureau of mines, Washington, recently has published data on the investigation of an electrolytic method for the determination of inclusions in plain carbon steels. The work was conducted by G. R. Fitterer, B. E. Sockman, A. E. Krockenberger, R. B. Meneilly, E. W. Marshall Jr., and J. F. Eckel. The paper is research investigation 3205.

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

-HERMAN-
MOLDING
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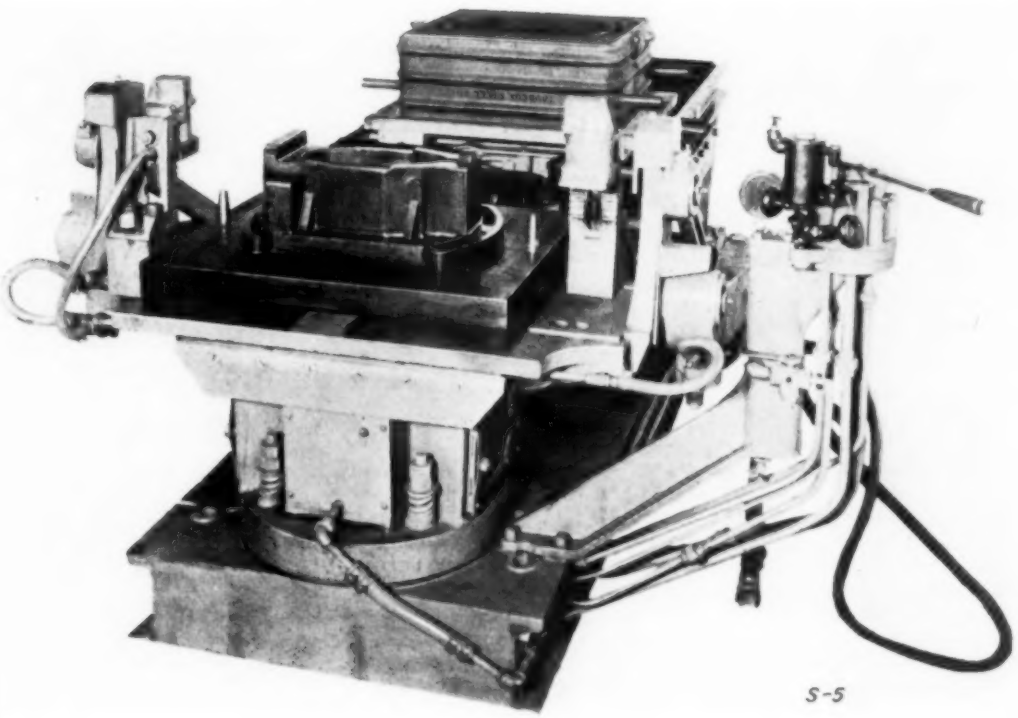

Herman 750 lb. Capacity Jarr-Rollover

This is the machine which created so much interest at the recent exhibition. We are more than pleased at its enthusiastic reception. Modern foundrymen appreciate its speed, its construction, its operation. Properly served, equipped with automatic air clamps, fluid timing valve and gravity rolls, production of a mold a minute has become a reality in many foundries. Why not join the list of satisfied users?

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She tells him every thing—some times

The Adventures of Bill

BY PAT DWYER

"WELL," said Bill, as he sat all sprawled out in a veranda easy chair, "I see by the papers that man at last is coming into his own, receiving the recognition that is his due and all that sort of thing. No longer is he ignored, looked at askance or treated with frank indifference. From now on he is a personage, worthy of recognition in the society columns, the cynosure—if I may say so—of all eyes. In a word, my lad, to be brief, he has arrived."

"Certainly," I admitted, "that is a highly gratifying piece of intelligence. So he has arrived, eh? Perhaps if you kindly asked him to step up here for a moment he could tell me what you are talking about. Who is he? What papers carried this astounding news? Into his own what, and who wants to recognize him? Why was he ignored, looked at askance, et cetera? As to getting into the society columns of the papers and being a cynosure—or did you say a centaur?—well, what about it? Undoubtedly a centaur presents alluring possibilities based on beer holding capacity, but on the earnings of the average citizen today a centaur capacity might prove a liability rather than an asset. Who is this remarkable person? Can I find him in *Who's Who?*"

"No," said Bill. "You can't find him in *Who's Who* or in what's what. And that, my lad as we say down home, is that. The man to whom I refer—please note that whom—the man to whom I refer is none other than the famous forgotten man, the man usually overlooked completely, but who occasionally receives a one line notice in a two-column wedding story: 'The bridegroom is the younger son of Mr. and Mrs. Angus Q. Whiffletree.' That's all. No person knows or cares who he is, where he came from or whither he is bound. Usually," Bill added cynically, "the unfortunate lad does not know himself, so I suppose that makes it unanimous all around."

"Unanimous with me," I agree heartily. "That unequal division of notoriety among the sexes always has obtained and probably always will. Now when I was married—"

"Yes, yes," Bill interrupted. "I know. When you were married you were in such a daze you started to walk out without feeing the clergyman. The bride—I have her own word for it—nearly died of embarrassment. However, you are all wrong in your statement that the bridegroom always played second fiddle. Also in your gratuitous assumption that he always will continue to perform on that lowly instrument. 'Twasn't so in the good old days when the cave man sallied forth and dragged 'em home to his nest by the hair or the heels. According to what I see in the papers the bridegroom once again is becoming recognized as one of the face cards in the deck. In newspaper parlance he is featured in the wedding story."

"I am not what you might describe as a wedding story fan," I admitted, "but occasionally I have one of these stories directed to my attention by a certain lady who always reads that section of the paper first. Up to the present I have seen nothing of that tendency you mention of giving the bridegroom an even break in the story. What papers have you been reading?"

The boy friend takes her for a spin

"Well," said Bill, "I'll tell you. Possibly I exaggerated a trifle when I referred to papers. To be strictly accurate I have read the story in only one clipping from the old home paper. However, even one clipping shows which way the wind is blowing or the twig is bent, or something like that. Whoever wrote the story is out to put the bridegroom back on the proper pedestal. More power to his arm! Listen here and get an earful of this little wedding story.

Mr. P. Kahn Nut III, son of O. L. D. Hickory Nutt II and Mrs. Hazel Nutt, The Nuttery, Chestnut Drive, became the bridegroom of Miss Amelia Acorn at the hour of high noon today. The ceremony took place at the palatial home of the groom's parents and was largely attended by the elite from far and near. Out of town guests included Mr. and Mrs. Pine Cone, Tarrytown; Mr. and Mrs. K. O. Konutt, Honolulu; Mr. and Mrs. K. U. Ku, Tokio; and Mr. and Mrs. C. O. Coon, Shanghai.

Mr. Nutt was attended by Mr. Beech as groomsman. As the groom approached the altar he was the cynosure of all eyes.

"Ah," I said, "I see now where you found the cynosure. Trying to put something over on me, eh?"

"Not at all, my lad. Not a-tall. It's a perfectly good word, moves in the best society and I kind of figured you would be pleased to see me take it out for a little run around the block. If you have no further objection to offer— le's see, where was I? Oh, yes, the bridegroom, young Nutt to you, was the cynosure of all eyes.

Blushing prettily through the back of his neck and ears, he replied to the questions of the officiating clergyman in low but firm tones. His playful parry to the question "Do you take this woman," etc., was "Aw be yourself, kid. What do you think I came here for? To play pinochle?" All those within hearing, vowed that was indeed a good one.

He was charmingly clad in a three-piece ensemble consisting of coat, vest and pants. The coat of severely plain dark material was cut rather high about the neck, draped over the shoulders, tastefully gathered under the arms and cut back on the bias from the waist line to terminate in long

pennons or sweepers at the back which reached nearly to the knees.

"You will pardon the interruption," I said, "but is the reporter referring to a cow or a bridegroom? So far as my knowledge and observation extend bridegrooms' knees invariably are in front."

"So is your old man. Likewise your old man's son, always in front with a silly kick of some kind. Did I write the thing? No. Well then, listen. Here's something to remind you of the famous old song *The Hat Me Father Wore*."

A very pretty story was current among the wedding guests that the coat was the same one that was worn by the groom's father and grandfather on their wedding day. Mr. Nutt neither would affirm nor deny the truth of this charmingly sentimental rumor. It—

"The coat of course, not the rumor," Bill remarked parenthetically.

It was gracefully fashioned with flaps over the side pockets and at the back was held together by a strap and buckles of the same material.

The groom's pants were of dark worsted and were suspended from the waist, falling in a straight line almost to the floor. A single pleat or crease extended from the top to the bottom at the front and back. The severe simplicity of the garment was relieved by the right pant leg which was caught up about four inches by a Boston Brighton worn underneath, revealing just the artistic glimpse of holeproof above the boots of genuine leather, laced with strings of the same color. The general effect was decidedly chic.

"Kind of a leghorn chick," Bill interpolated. "Har, har!"

Beneath the vest the groom wore blue galluses powdered with white forgetmenots, attached to the pants fore and aft and passing in symmetrical curves over the shoulders. This decidedly pretty and useful part of the costume might have passed unnoticed had not the groom unfortunately muffed the ring when the groomsman unobtrusively attempted to slip it to him. When he stooped to recover the errant circlet the pants and suspenders were prettily revealed.

His neck was encircled by a stiffly starched white linen collar characterized by a slight saw edge. Around the collar a cravat was loosely knotted so that it rode under his left ear in that studied effect of carelessness which marks supreme artistry in dress.

Mr. Beech's costume was essentially similar to that of the groom. When the two stood at the altar, a hush of awed admiration enveloped the audience at the complete and wonderful harmony of their raiment. Actually one could hardly tell one from the other had it not been for a patch of court plaster worn by the groom to cover a cruel nick in the chin made by a safety razor. Neither Mr. Nutt nor Mr. Beech wore a hat during the ceremony.

"Then," said Bill, "the supreme, the finishing touch. Get this:"

Miss Acorn wore the conventional veil and orange blossoms.

"There y'are," Bill concluded. "The bridegroom gets a column story out of the thing and the bride gets only one skinny line. If that is not a sign of something, I'd like to know what it is."

"If you ask me," I said, "I think it is a sign you should leave wedding stories alone and devote your time and talents to catastrophies of one kind or another in the foundry. Anything new in the mail bag recently?"

"Well, said Bill, "I'll tell you. The answer is yes and no. The inquiry was new but the subject was old. I had an inquiry from a lad who said that for some time they had been dusting

A fair question any way you look at it

their green sand molds for steel castings with portland cement and had noted that the skin of the castings was cleaner than usual. The cement absorbed the moisture from the face of the mold and formed a skin similar to that on a mold exposed to any form of skin drying agency. Formerly the molds for the heavier castings were dried with charcoal, but with the cement facing this treatment was not necessary. He wondered if the cement would affect the chemical composition of the metal, or, would it impair the quality of the sand if used continuously.

"Use of portland cement as a facing material is not a new departure. It has been tried experimentally both in the gray iron and steel foundry, but the practice never has been adopted to any extent. The greatest objection to its adoption is the tendency to cake upon exposure to moisture. Theoretically it can be kept dry, but in actual foundry practice it is constantly exposed to moisture. Between the moisture in the air, and water which constantly falls where no person expects it to fall, more cement becomes caked and useless, than is used to face the molds. Unless the amount is calculated carefully in proportion to the moisture in the sand, the surplus cement on the face of the mold will roll ahead of the molten metal and cause dirty areas on the face of the casting.

"The great aim of the foundryman is to maintain a maximum permeability in his sand. Although I cannot call to mind an instance where continued use of cement facing ruined the permeability, still I am inclined to the opinion that its use is detrimental. In the only instances with which I am familiar, use of cement was discontinued for other reasons before the sand was affected.

"I do not see how the cement will affect the chemical composition of the metal. It is prepared at a higher temperature than that of molten steel, therefore no further reaction will take place when it is exposed to the molten steel in the mold.

"The essential elements of portland cement are lime, silica and alumina. Some cement mills use cement rock and limestone; some use limestone and clay or shale; others use marl and clay; while still others use blast furnace slag and limestone. This material in proper proportions is ground to a powder and then burned in a kiln at a greater temperature than that required to melt steel. The resulting clinker is cooled and then ground to a powder so fine that 75 per cent will shake through a sieve with 40,000 holes to the square inch—a sieve that is finer than silk—a sieve that will hold water. The material is cheap, it imparts a clean skin to the casting, but it has not found favor in the foundry industry. In limited amount it may not affect the permeability of the sand for a long time, but where it is used extensively the sand is bound to tighten up in a short time and cause cuts and scabs."

Elects Officers

Louis E. Murphy recently was elected president of E. F. Houghton & Co., Philadelphia. Major A. E. Carpenter, first vice president and treasurer, resigned the latter office and was elected general manager, George W. Pressell, second vice president and secretary, resigned as secretary and was elected assistant general manager and director of sales, Dr. R. H. Patch, director of plants, was elected treasurer, and A. E. Carpenter III, assistant to general sales manager, was elected secretary.

Research paper No. 533 issued by the bureau of standards contains information on the method of determining the aluminum content in nitriding steels through the use of 8-hydroxyquinoline. Data also is given on the experimental work upon which the recommended procedure is based. Copies of the paper may be obtained from the superintendent of documents, Washington, D. C., for 5 cents.

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Intricate Design

Intricate Steel Castings for Automobiles, by A. D. Kirby, the *Foundry Trade Journal*, May 11, 1933.

The automobile engineer incessantly is calling for castings so intricate in design, and so thin in section, that a few years ago it would have been thought almost impossible to produce them in steel. Since the introduction of the electric furnace the steel founder has a melting unit over which he has complete control.

To simplify the jobs, making them suitable for machine molding, it sometimes is necessary to block out certain parts of the pattern and utilize cores. Generally speaking, greater freedom from tears in the casting is experienced when using oil sand cores. The use of chills often is condemned, and it must be admitted that the indiscriminate use of chills, whether external or internal, is to be deplored Careful attention must be paid to the condition of the sand and molds should be poured with stopper ladles. The method of bottom pouring has its detractors, but it probably is the best method to employ when dealing with castings described.

Solidification

Cast Steel: Structure—Heat-Treatment—Properties, (L'Acier Moule: Structure—Traitements Thermiques—Proprietes) by Dr. Georges Delbart. *Bulletin*, Association Technique de Fonderie, Paris, March, 1933.

Properties of cast steel depend principally upon: Chemical composition; state of oxidation and inclusions; solidification of the liquid metal into solid solution (primary structure); change of the solid solution into alpha iron + perlite (secondary structure); heat-treatment, which modifies the morphological characters of the primary and secondary structures.

Mechanism of the solidification of cast steel forms the main part of the paper, and the discussion is accompanied by micrographs and curves. The practical conclusions reached are: (1) It is of interest to use those alloys that are less subject to dendritic formations; (2) Slow cooling in the interval of solidification should be avoided, because it then favors dendritic formation, intercrystalline liquation and segregation; (3) Slow cooling in the austenitic region is recommended, because it favors the homogeneity of the solid solution; (4) Slow cooling in the A_2—A_1 interval is to be avoided.

These conclusions determine, to some extent, the heat-treatment. Quality of the metal, thickness of walls, contents of carbon and silicon, and of additions, also are important factors. A warning is given that excessive superheating treatment destroys the favorable effects of reheating to obtain greater homogeneity. The duration of the heat-treatment is function of the thickness of the casting. Importance of properly locating the test-pieces taken from a cast block is stressed, as this has a marked influence on the results obtained.

Resists Oxidization

High Silicon Cast-Irons, (Les Fontes au Silicium) *La Revue de Fonderie Moderne*, Paris, April 25, 1933.

This article gives the results obtained from tests made by the Compagnie Generale des Conduites d'Eau, of Liege, Belgium, with a view to obtaining irons resisting to the various causes of disintegration due to exposure at high temperatures. High temperatures cause deformations due to growth, and destruction by oxidation. There are two ways of combating these effects: one by introducing in the metal elements capable of forming stable carbides; the other by making a stable iron containing only the two elements: ferrite and graphite, the latter in fine grains uniformly distributed.

The second solution was adopted and it was found necessary to have low total carbon, to remain near the eutectic zone, and to obtain a ferritic structure with an element tending to slow down oxidation. Low carbon, on the other hand, gives perlitic structures, and sometimes even cementite. Therefore it is, necessary to reduce the combined carbon by adding silicon, which itself slows down oxidation.

Is was found that the six groups of iron in which silicon ranged from 3.80 to 6.02 per cent were good from the standpoint of resistance to oxidation, but with regard to the additional requirements of mechanical properties and expansion, several groups had to be discarded, the one group answering to all requirements having the following analysis: Carbon 2.54 per cent; silicon 5.30 per cent; manganese 0.266 per cent; phosphorus 0.12 per cent; sulphur 0.049 per cent. It is emphasized that high silicon irons, while resistant to oxidation, must be entirely ferritic in order to resist the deformation effects of high temperatures.

Cylindrical Cores

Shapes Cores in Loam, (Noyautage de Formes en Terre) by the technical commitee of the Belgian foundry association. Rapporteur: A. Philippart. *La Fonderie Belge*, Liege, February, 1933.

This article follows the series on cylindrical cores previously reviewed. The simplest forms are cubes and parallelopipeds. Two methods can be employed for small cores: (a) preparing a rough shape by hand and reducing it to the required proportions by hand scrapers; (b) drawing the core through a wooden die.

For larger cores, a combination of these methods can be used, and provision must be made for using and placing reinforcing bars.

Porosity

Prevention of Porosity in Castings, by John A. Smeeton, the *Foundry Trade Journal*, London, June 22, 1933.

A discussion of the application of chills in the prevention of porosity in ferrous and nonferrous castings, including the use of cooling spirals, is included in this article.

Molybdenum in Steel Castings

(*Continued from Page 27*)

num steels are more resistant to tempering than are molybdenum-free steels. A higher drawing temperature is required to soften them to a given brinell hardness than is the case with steels of similar strengths and hardness which are molybdenum-free. Hence, casting strains may be eliminated by long high-temperature draws while retaining high hardness and strength.

Rate of cooling after the draw is not so important in molybdenum steels as it is in some other alloy-casting steels, because molybdenum is a specific against *temper brittleness*. This is most important and characteristic property conferred by molybdenum, as the behavior under impact test of some heat-treated alloy steel castings has been completely wrecked because of temper brittleness.

It requires a considerable content of molybdenum in a straight carbon-molybdenum steel to produce a high-strength product comparable, by the conventional physical tests, to some other fairly low-alloy steels. Since molybdenum costs 80 to 95 cents (the salt 80 cents, ferroalloy 95 cents) per pound, the plain molybdenum steels ordinarily are not used where static figures alone determine their suitability. However, it happens that many of the inherent properties conferred by molybdenum on steel are shown as the result of the addition of quite small amounts of it, with great static improvement, if it be used in conjunction with other alloy additions.

Use Only Small Amount

In fact, the modern (quaternary) molybdenum steels contain only about 0.15 to 0.30 per cent molybdenum. With this small amount such steels approximate the static properties of much more highly alloyed nickel and/or chromium steels while actually containing perhaps only half as much of those alloying elements, thus attaining all the good properties which such alloys confer upon steel. Hence, the cost of the small molybdenum content may be well repaid by the saving in larger amounts of their other alloys. The use of molybdenum, therefore, may be economical and deserves consideration whenever an alloy steel is required.

A further feasibility of using molybdenum lies in the fact that the recovery of the metal from the ferroalloy—calcium molybdate, or molybdic oxide plus lime—is high. Since molten iron will reduce molybdenum from its oxide, there is practically complete freedom from loss of the metal when remelting gates and risers. The use of molybdenum introduces no new foundry difficulties and has been said to minimize some of the old ones; for instance, cracking in the mold.

Molybdenum is compatible with other alloying elements and, as previously stated, reduces the amounts of those elements which are required. Hence, we have the manganese-molybdenum, the chromium-molybdenum, the nickel-molybdenum, and the vanadium-molybdenum steels, or molybdenum steels containing two, three, or even four of other alloying elements. It enables the attainment of combinations of high mechanical properties which may be sought in quenched and tempered steels. A favorite steel contains nickel, chromium and molybdenum, the amounts of the elements decreasing in that order.

As is general with all alloy steels, if we build up a complex steel containing molybdenum we should be careful to hold down the carbon as we add alloys, so as to get maximum ductility for a given strength. Most of the casting alloy steels containing molybdenum run from 0.20 to 0.40 per cent carbon and seldom go above the higher figure.

An interesting and economical steel for casting is manganese-molybdenum, since molydbenum accentuates the alloying effect of the manganese—which latter effect seems to come into play after an amount of some 0.6 per cent manganese is present. The manganese itself is a cheap constituent. The higher manganese tends to good deoxidation and freedom from nonmetallic inclusions. Molybdenum has no such reaction, although it certainly has no harmful effect along these lines.

There is an increasing tendency to, and utilization of cast steels with 1 to 2 per cent manganese and 0.20 to 0.30 per cent molybdenum in the normal carbon ranges, and for ordinary uses, as the manganese percentage goes up the carbon should come down.

Raises Impact Values

Analyses of some cast steels tested at the Norfolk navy yard are given in Table I, and the properties of these steels after heat treatment are shown in Table II. Properties of the manganese molybdenum steel listed as heat No. 5 compare favorably with those of the other alloy steels, and its high impact value tends to disprove the belief that molybdenum in cast steel is conducive to low impact values. Impact values produced by other heat treatment also were high.

An unusual application of higher carbon manganese-molybdenum steel is in car wheels, where a hardness of 300 brinell is required after a 1575 degrees Fahr. air quench with a subsequent draw high enough to insure freedom from all casting strains. The steel formerly used for their manufacture contained about 0.70 per cent carbon and 1.35 per cent manganese, and was normalized and quenched with a subsequent draw of 1000 degrees Fahr. This draw could not be raised with concurrent retention of the specified hardness. By adding 0.20 to 0.25 per cent molybdenum to the steel, the draw could be raised to 1100 degrees Fahr., giving increased strain relief while still attaining the desired hardness.

When cast steel of fine grain is desired, the addition of a little vanadium to a plain molybdenum steel proves a successful combination. This is utilized at Watertown arsenal, where centrifugally cast guns replace forged guns in some cases.

Spring found a cast steel of 0.9 per cent chromium and 0.25 per cent molybdenum content to be superior in high-temperature creep resistance to one containing 2 per cent nickel and 0.9 per cent chromium. Again, molybdenum is finding much use in castings containing 5 per cent or more chromium for high-temperature service. The molybdenum addition in these steels is usually about 0.50 per cent; however, a molybdenum content of 0.60 to 0.70 per cent is employed by some producers.

At present, cast chromium-molybdenum steels are not so relatively common as are wrought steels of similar compositions. However, their use is extending rapidly on account of their excellent abrasion-resisting

Alloying Element

CONSIDERABLE interest has developed in recent years in the use of molybdenum as an alloying element in ferrous metallurgy. Numerous advantages which accompany the use of the alloy in steel castings, are discussed in this article, including the readiness with which molybdenum fits in with other alloying elements to give steels high in physical properties when quenched and tempered, the added ease and certainty in hardening throughout in quenching and the ability to remove casting strains by a high temperature draw without softening castings too much. The article is from a paper presented at the annual convention of the American Foundrymen's association in Chicago, June 20 to 23. H. W. Gillett is director and J. L. Gregg metallurgist, Battelle Memorial institute, Columbus, O.

qualities. Quenched and tempered nickel-molybdenum cast steels are used extensively and enjoy a reputation for especially good impact resistance for a given strength.

Heat-treated alloyed steel castings frequently are used in place of forgings for purposes which few today would have thought some years ago could ever be satisfied by castings. Large castings which then would have been made only in the annealed or normalized condition are now being quenched successfully, in air or oil, and subsequently tempered.

The readiness with which molybdenum fits in with other alloying elements to give steels high in physical properties when quenched and tempered, the added ease and certainty in hardening throughout in quenching produced by molybdenum, and the ability to remove casting strains by a high temperature draw without softening castings too much, make the element a good friend alike to steel foundrymen and to the user of steel castings.

Electric Furnace Iron

(*Concluded from Page* 26)

born Co., Cleveland, as shown in Fig. 3. Due to the low carbon iron used for the castings, it was found necessary to employ a different method of gating than ordinarily is used on manifold castings and similar work. Generally, such castings are gated along the bottom edge with a number of thin, flat gates joined to a runner extending the length of the casting.

That method permits the metal to enter from the bottom and gradually rise until the cavity is filled. Ordinarily, that method produces good castings, but in the case of the iron used by the Eaton-Erb company, difficulty was encountered from cold shuts. Consequently, the bottom gates were eliminated, and the castings gated from the top as shown in Fig. 3.

Cast on Chill Plates

Due to the increasing speed and more drastic service requirements of the modern automobile and airplane engines, it became necessary to produce a stronger valve tappet which not only possesses a high shock resistance in the head and neck, but also excellent wearing quality on the face. After considerable experimental work, the firm developed tappets of several different types to meet the requirements. The tappets have a chilled face which must be controlled closely as to depth so that the stem will be machinable and the head and neck will be resistant to shock.

Metal used for the valve tappets contains 1.75 per cent nickel and 0.75 per cent molybdenum with a total carbon content of 3.2 per cent. The tappets are cast against a chill plate forming the drag while the head and neck are formed in green sand. Fig. 2 shows the cope containing the sprue and runner cavities at the left, the iron chill plate forming the drag in the center, and the cheek containing the head and neck cavities on the right.

One feature of the chill plate is that it contains a number of parallel shallow grooves spaced about $\frac{1}{8}$-inch apart. Use of the grooved chill plates which is a patented feature in the production of chilled tappets, serves two purposes. One is that the grooves aid in venting the mold, and the other, of greater importance, is that the grooves reduce to a large degree the appearance of wrinkles or waviness which occurs on work cast against a chill. It is said that the grooves not only reduce the quantity of wrinkles but also the depth of penetration. Consequently, less material has to be ground from the faces for their final finished form.

Burn Coke Oven Gas

Each mold contains cavities for 32 tappets, and the cheek molds are made on jolt squeeze molding machines manufactured by the Milwaukee Foundry Equipment Co., Milwaukee. Cope molds containing the sprue openings and runner cavities as shown in Fig. 2, are made on squeezer machines supplied by the Osborn Mfg. Co., Cleveland.

Cores for castings made in both the sand mold and permanent mold shops are made in a room adjoining the permanent mold division. Lake sand with an oil binder is used for the cores, which are made on the bench or on hand, jolt core machines. The cores are baked in five batch type ovens fired with gas. In addition to the gas firing, the ovens are equipped with recirculators which permit burning of the gases given off by the cores during the baking operation.

Book Review

Displacement of Men by Machines, by Elizabeth Faulkner Baker, cloth, 284 pages 6 x 9 inches, published by the Columbia University press and supplied by THE FOUNDRY, Cleveland, for $3.50, plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This book probably records the first published effort dealing both with changing technology and labor displacement in representative plants and with the subsequent economic history of the men displaced also included. The author has chosen the printing industry upon which to base a study of the problem caused by mechanical innovations.

If this investigation of a specific branch of industry teaches a lesson, the author believes that it is this: Until we devise a method of absorbing displaced workers in self-respecting occupations without serious or protracted periods of unemployment, we cannot speak of social progress and the substitution of men and machines in the same breath. As productivity increases it is becoming more glaringly evident that cultural services are as badly needed as material goods, and that judgment and foresight, informed by the mistakes and omissions of the past, are imperatively required in solving the problems presented in each new technical advance.

Take Steps to Formulate a Code

A meeting of representatives of the nonferrous secondary metals industries was held at New York on June 29, when it was decided that two representatives each from the Non-Ferrous Ingot Metal institute, Aluminum Research institute, and Metals division of the National Association of Waste Material Dealers will meet with two representatives each from the white metal manufacturers and other metal industries as may be found desirable, to formulate a code for submission to the Industrial Recovery board.

Personnel of the joint committee is, at present, as follows: Ivan Reitler, New York, chairman; George Bangs, New York; George Birkenstein, Chicago; L. Chapman, Chicago; Henry Levitt, Detroit; T. Lewin, East St. Louis; Louis Lippa, Chicago; E. E. Oury, Nashville, Tenn.; F. Schmutzer, New York; P. E. Sprague, Hammond, Ind.; Walter M. Weil, Cleveland; C. B. White, Philadelphia.

R. D. T. Hollowell, Chicago, manager of Non-Ferrous Ingot Metal institute and Aluminum Research institute, is co-operating with the joint committee by acting in the capacity of secretary.

Reduces Accidents

A reduction of 16 per cent in accident frequency rate of the 3937 industrial members last year was shown in the annual report of the National Safety council. Since rates were established on the basis of man-hours worked, the difference in employment in the years 1931 and 1932 had no bearing upon this achievement. Severity rates in 1932, according to the report, were 6 per cent below the 1931 figure.

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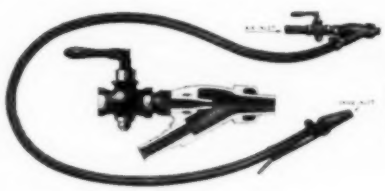

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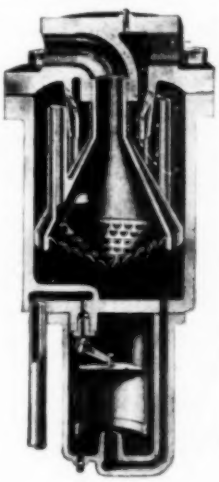

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Wear Resistance of Malleable

(*Continued from page 29*)

The tensile strength of chromium-silicon malleable iron is from 10,000 to 25,000 pounds per square inch more than that of ordinary malleable iron, generally given as 55,000 pounds per square inch. An effort is made to determine the effect of the ratio of the additional silicon to chromium, on the tensile strength. By additional silicon is meant that in excess of the normal amount in the base mixture; in other words, the excess silicon added in the ladle with the chromium.

In Fig. 4, X is used for irons where the ratio of additional silicon to chromium is less than 0.71, and O where this value lies between 0.71 and 1.05. It is evident from Fig. 4 that the lower ratio gives greater strength, as would have been expected from the individual effects of silicon and chromium on malleable iron.

Increasing the chromium increases the yield point regardless of the amount of silicon present, as is shown in Fig. 5. It is interesting to note that the elastic limit of the chromium-silicon alloyed irons is not only higher in pounds per square inch but also is higher in per cent of ultimate strength than is that of ordinary malleable iron or cast steel. The A.S.T.M. specification A47-30 calls for yield point of 32,500 pounds per square inch, while the lowest one obtained on a chromium-silicon iron is 41,000 pounds. This great increase in the elastic limit is a matter of great commercial importance, for it has been recognized in recent years that the yield point, or point at which permanent deformation takes place, is often more significant than the ultimate breaking load.

Higher Ductilities Not Maintained

Regardless of higher silicon, high ductilities are not maintained with high chromium present. The data obtained are insufficient to permit one to draw any conclusions on this point. In fact, it seems highly probable that a different heat treatment might increase the ductility materially. The effect of raised chromium on the elongation is shown in Fig. 6.

As shown in Fig. 7, the hardness as measured by brinell hardness rises with increased chromium, except in two cases where so much silicon is present that it partially counteracts the hardening effect of chromium. This graph emphasizes the necessity of keeping the ratio of excess silicon to chromium in a technically regulated proportion.

In general, this ratio is not nearly so important as the absolute amount of chromium present. However, it explains some seeming discrepancies in results and should be considered when planning additions of this kind.

Adds Chromium

WITH a view of developing a wear resistant malleable iron, a series of experiments was conducted to determine the effects of varying amounts of chromium. The chromium additions ranged from 0.25 to 1.15 per cent with the silicon varying from 1.02 to 2.02 per cent. Maximum tensile strength was secured with 0.84 per cent chromium and 1.57 per cent silicon. Elongations decreased as the chromium increased. Hardness also increased. Elastic limits increased up to 62,500 pounds per square inch. The article is abstracted from a paper presented before the recent Chicago convention of the American Foundrymen's association.

A micrograph of the standard malleable iron test bar shows that the structure is temper carbon in the conventional form, surrounded by grains of ferrite, with no pearlite visible.

This iron is the best type of ductile malleable casting, meeting the A.S.T.M. Specification A-47-32T, grade 35018. The ferritic structure, of course, accounts for the softness and ductility of this standard malleable.

Fig. 1 shows, at 100 diameters, the excellent structure obtained by the use of small amounts of chromium with increased silicon. Tensile strength is 67,000 pounds per square inch, elastic limit 41,000 pounds per square inch, elongation in 2 inches 12.5 per cent, and brinell hardness 175. The temper carbon is slightly smaller than in the unalloyed malleable, and appears to be farther apart. A few patches of ferrite surround the temper carbon, and some very fine particles of unbroken carbides can be seen. The matrix is exceedingly finely laminated pearlite. Fig. 2 shows the same structure at 375 diameters. A network of ferrite is visible, but even at this magnification the fine structure is evident.

Fig. 3 shows the same sample at 800 diameters. The ground-mass, which at 100 diameters has the general appearance of a sorbitic pearlite, now can be seen to be almost entirely a finely divided lamellar pearlite, surrounded by a network of ferrite. There is some evidence of a slightly spheroidized form in some of the pearlite, this undoubtedly being due to the well-known tendency of chromium-bearing pearlite to spheroidize at approximately 1550 degrees Fahr., which happened to be the annealing temperature in these experiments.

The finely laminated pearlite present in the matrix accounts for the hardness and high yield point of this iron and should contribute greatly to the wear resistance.

Higher chromium reduces the size of the temper carbon particles even more, as appears in Fig. 8. The matrix is composed of finely laminated pearlite, as before, and more unbroken carbides are present in dendritic form. Physical properties show a tensile strength of 80,500 pounds per square inch; elastic limit 52,500 pounds per square inch; elongation of 6.00 per cent in 2 inches; and a brinell hardness of 201.

Fine Graphite Gives Strength

The fine graphite and pearlite account for the great tensile strength of this bar, but the decreased elongation and increased hardness probably are due to the unbroken carbides.

Fig. 9 shows the exceedingly fine structure obtained with 1.14 per cent chromium and 2.02 per cent silicon. Small graphite, finely laminated pearlite, and more little patches of unbroken carbides can be seen. There is hardly any ferrite visible. Physical properties are as follows: Tensile strength 67,000 pounds per square inch; elastic limit 62,500 pounds per square inch; elongation in 2 inches, 2.5 per cent; brinell hardness 202.

It is interesting to note that the elastic limit increases steadily with higher chromium, although so much silicon is present in this case that the strength is not so great as in other samples. The low ductility and great hardness probably are caused by the unbroken carbides.

To summarize, additions of chromium and silicon in the ladle to standard malleable base mixtures change the structure of the annealed malleable so as to decrease the ferrite, refine the temper carbon, and cause a pearlitic structure. The effect of these changes on the physical properties is clearly understood when one remembers that ferrite has a tensile strength of about 50,000 pounds per square inch, and pearlite about 125,000 pounds per square inch, with 10 per cent elongation.

This paper is offered as a progress report, and the author hopes that it may open new fields of investigation. Possible uses for this type of metal will occur to any malleable executive.

No variations were made from the standard heat treatment, although much greater ductility and other physical properties can be obtained by heat treatment specially designed for

(*Concluded on page 64*)

Auto Malleables
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Stove Burners
Manifolds
Pipe Fittings
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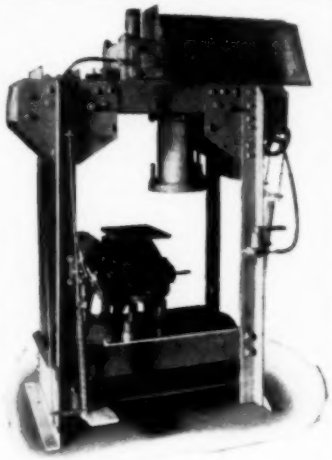

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Stocks of Glutrin and Goulac are carried in principal cities and furnished by leading foundry supply houses. Carload shipments of Glutrin from Au Sable Forks, N. Y., and Erie, Pa., and Goulac from Erie, Pa.

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*1

the solution of the stable carbides in such irons. However, since this series of tests was to be under strictly commercial production conditions, the regular annealing practice was followed. It will be interesting to watch the development of this type of iron when special heat treatments are used.

These results also brought up the question of the use of chromium with higher silicon for the prevention of primary graphitization in heavy sections. The author is continuing this work at present.

It may be thought that elongations of from 7 to 13 per cent are not very high, but it must be remembered that within the last two decades serviceable malleable castings were made to specifications requiring far less ductility and strength than the irons which form the basis of this article. A brief comparison of physical properties of several irons illustrating this point are shown in Table II.

Alloy Cast Iron With Titanium

(*Concluded from Page 33*)

sistance to cutting of the various samples under identical conditions. Samples for which no values are given were not tested.

Because of restricted space allotted to this article, no discussion of the tabulated results is possible. The microstructures and fractures of all the samples were studied and two are shown in the accompanying illustration. The structures showed consistently finer graphite in the titanium-treated samples than in any of the others. In the illustrations the black spots are graphite, the gray is pearlite or sorbite and the bright areas are steadite, probably containing chromium carbide. *A* shows an iron containing 0.43 per cent chromium and no nickel, treated with 1.5 per cent ferrotitanium. *B* is an iron containing 0.36 per cent chromium and 1.2 per cent nickel, not treated with titanium.

The increased strength in the chromium-bearing irons seemed to be due to the absence of any free ferrite and to a finer lamellar structure of the pearlite. Chromium also was found to be evident in the microstructure because of the presence of a hard, white constituent, probably chromium-carbide, associated with the spotted steadite (phosphide eutectic) found in all the samples.

The fractures of these irons, both in the test-bar size and in ¼-inch sections, also were interesting. The titanium-treated irons could be recognized in every series by their fine grain and dark fracture. The samples treated with chromium alone showed the most chill in the ¼-inch sections, and titanium was found to have the same effect as nickel in counteracting the extra chill due to chromium.

The most striking effect of titanium in cast iron as brought out by these tests was the refinement of the graphite particles, or "closing of the grain." In actual practice, the alloy is now being used largely for that purpose.

The best results in increasing the strength of cast iron were obtained with titanium and chromium, and it is somewhat surprising to note that the iron alloyed in that way was no more difficult to machine than untreated iron.

Malleable Club Studies Point System

Twenty members of the Malleable club, Milwaukee, attended the regular dinner and meeting of that group at Old Heidelberg Inn on June 13, with Professor Scott Mackay, department of metallurgy, University of Wisconsin, presiding. Bernard Gapinski, Milwaukee Malleable & Gray Iron works, Milwaukee, led a discussion on making estimates from blueprints. M. W. Gleisner, superintendent, Walker Mfg. Co., Racine, Wis., continued the discussion started at the previous meeting, on the point system for estimating piece work molding rates as applied to gated patterns using a sand match.

The following committee was appointed to arrange for a summer meeting and outing to be held the last week in July: E. P. Meyer, Chain Belt Co., Milwaukee; M. W. Gleisner, Walker Mfg. Co., Racine, and J. Bissett, Wisconsin Appleton Co., South Milwaukee, Wis.

Book Review

Some Fundamentals of Association Advertising Procedure, by F. J. Ross, cloth, 50 pages 6 x 9 inches, published by Fuller & Smith & Ross Inc., and supplied by THE FOUNDRY, Cleveland, for $1.50, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This book answers pertinently 29 fundamental questions about business associations and demonstrates the need of business statesmanship in forming such associations in this era of competition among industries. In answer to the question whether there is room for business statesmanship amid competitive antagonisms, the author writes: "Until an industry in its committee and convention work reaches the conception that competitors, however keen, have extremely important common interests—that a healthy state of their common interests is indispensable to constructive competition—that destructive competition is an invariable reflection on business statesmanship—that there is more actual profit to accrue from the money invested in promoting the common cause than from an equal amount spent in destructive competition—it is not ready to start."

The author believes that an association should advertise "to gain benefits which co-operative effort can best secure or secure alone." Increased consumption is the first of these. The initiative for the success of association advertising should come from within, for it is unsound for an industry to be led into an associative endeavor except by its own best leaders. The author then answers questions as to when an association should advertise, if it should proceed with a campaign even if its largest members do not participate, what are the logical classes of members to include in a co-operative campaign for a commodity, whether related industries can co-operate, and how long an industry should advertise.

The second part of the book discusses in detail the procedure for an association advertising campaign. The introduction to the book was prepared by Hugh E. Agnew, chairman of the department of marketing of the school of commerce, accounts and finance, New York university.

Foundrymen To Meet In Czechoslovakia

An International Foundry congress will be held at Prague, Sept. 9-16, under the auspices of the government of the Republic of Czechoslovakia. The annual assembly of the Czechoslovak Foundry association and the meeting of the International Committee of Foundry Technical associations will be held in connection with the International congress. Arrangements are being made for visits to some important industrial plants in Prague and vicinity as well as sight-seeing trips through the city and surrounding country. Members of the congress will have occasion to visit the Prague Autumn Fair, and the Exposition of ornamental and artistic castings.

After the closing of the congress sessions, excursions will be made to industrial districts of the Czechoslovak republic. A special train of the state railways will be at the disposal of the congress members.

Sufficient room in a bucket elevator casing is essential to long life, it is pointed out by Ralph McMillan, Link-Belt Co., Chicago, since ample space does away with wear of buckets on the casing. Pits for elevators should be roomy to allow quick and easy access for adjustments, cleaning and lubrication.

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Aluminum

Cherry

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On that next rush job try the *Peerless Flask*—the one with the *Automatic Unbreakable Bronze Sand Supporting Strips*—and be convinced of the money-making, money-saving possibilities which only *Peerless* equipment can offer.

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We have the complete PAXSON patterns and
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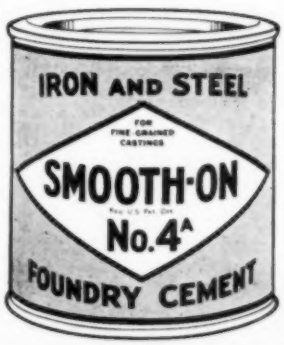
Surface correction makes good castings better



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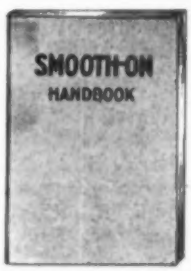

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Foundrymen See Developments

(*Continued from Page* 23)

setting of the valve moves the hopper over the corebox, admits the air and sand and then moves clear. A mixer on top keeps the sand in the reservoir agitated.

The International Molding Machine Co., Chicago displayed a new core blowing machine in which the corebox table is adjusted for various size boxes by hand wheel underneath and by a quick moving lateral adjusting device. An operating valve automatically controls the complete sequence of operations. The core blower plate permits rapid adjustment to fit various size coreboxes. The company also displayed a jolt strip molding machine and attracted considerable attention by a number of photographs of representative foundrymen's groups taken at the early conventions of the A. F. A.

A large jolt machine was shown by the Herman Pneumatic Machine Co., Pittsburgh, also a second large rollover machine of similar type equipped with a short roller landing table from which the finished mold can be pushed on to a conveyor without lifting by hand or crane. Both these machines are equipped with the special control valve for regulating the number and force of the jolts imparted to any given mold. One of these pieces of valve mechanism was on display independently to illustrate the operation.

Showed Moving Pictures

Through the use of a moving picture machine and several films, the Beardsley & Piper Co., Chicago, showed various types of foundry interiors where the sand slinging machine manufactured by the company is employed. A large jolt rollover, a smaller plain jolt rollover foot draw machine, a small core rollover machine, also a number of snap flasks and reinforced slip flasks, were shown by the Arcade Mfg. Co., Freeport, Ill.

W. H. Nicholls Co. Inc., Richmond Hill, Long Island, N. Y., showed three heavy type combined jolt squeeze machines. The largest of the three is designed to squeeze and jolt heavy molds. The jolt cylinder, squeeze cylinder and housings are cast in one piece of high strength semisteel. The rollover cylinders are entirely enclosed. The molds are rolled over through a hydropneumatic principle which involves the use of both air and oil combining smoothness and safety.

Outstanding features of several machines shown by the Tabor Mfg. Co., Philadelphia, included oilless bearings on various moving parts, and sets of oil valves for regulating the rollover and pattern drawing movements by oil instead of air. Machines in which these features were displayed included a jolt rollover pattern draw machine with an ingenious movement in the upright side rods for minimizing the power required to roll the mold and an air operated leveling device to receive the rolled flask; a jolt rollover core making machine; and a jolt squeeze machine with a head which may be moved out of the way. This company also exhibited a sandblasting device.

Sand Falls on Belt

Several improved features in materials and design were shown in the sand mixing machine displayed by the Royer Foundry & Machine Co., Wilkes Barre, Pa. Sand thrown into a hopper on this machine falls on to a rapidly moving belt which disintegrates, aerates and throws the sand forth in condition for use. Scrap, small pebbles and all similar foreign material roll to the bottom of the machine by gravity.

A 6-foot pan mill equipped with pneumatically operated doors leading to the aerator attachments at either side of the bottom, also a new type center pedestal in which all bearings operate in an enclosed oil bath, were shown by the National Engineering Co., Chicago. One of these pedestals partly cut away to show the construction also was on display independently. A large rotary type sand mixer was shown by the Standard Sand & Machine Co., Chicago. Vibrating screens designed for the preparation of molding and core sands were shown by the Niagara Concrete Mixer Co., Buffalo, and by the Production Equipment Co., Chicago.

Samples of sand for foundry use were shown in great variety by the Great Lakes Foundry Sand Co., Detroit. The display included sands and refractories for core and molding departments, cleaning and melting departments; also tapered slip flasks and jackets. An artistic touch was added to the booth of the Illinois Clay Products Co., Joliet, Ill., by a a number of Japanese bronze castings of a goose, the emblem of the company. Exhibits included samples of fire clay, fire clay flour, fire brick and insulation material.

Tamms Silica Co., Chicago, displayed the application of a material for making matchplates and pattern mounts. The liquid material is poured into a prepared mold and in a short time it becomes solid and ready to be used. The base of the material is a finely ground silica and the resulting product presents a glass hard and smooth surface. The material comes in powdered form and is mixed with water. A master frame is employed to fit over the mold in which the plate is made. Any number of duplicate plates may be made in the same frame by inserting small inside frames held in place by a number of screws.

Another product for making matchplates in which the base material is lava, was shown at the booth of the Stone Pattern Mount Co., Inc., Bloomfield, N. J. Bags of shot and grit of many varieties with samples of metal faces finished by the materials were shown by the Globe Steel Abrasive Co., Mansfield, O. Numbers on the metal samples corresponded to the numbers indicating the size of the shot particles.

Several types of melting equipment for ferrous and nonferrous were represented. The Detroit Electric Furnace Co., Detroit, provided an interesting display of a wide variety of castings poured from steel, iron and nonferrous metals melted in the indirect arc, rocking type electric furnace. The casting on display included piston rings, automobile cam shafts, clutch plates, manifolds, 8-cylinder motor blocks, a cam for shoe manufacturing machines, locks, meters, nozzles, bearings, and piston packing. The company also showed test pieces having the brinell hardness numbers indicated at different points on the pieces.

Ajax Electric Furnace Corp., Philadelphia, and the Ajax Electrothermic Corp., Trenton, N. J., displayed a number of photographs showing interesting furnace installations. The Whiting Corp., Harvey, Ill., showed some colored photographs and a series of motion pictures on an artistic background. The colored photographs showed a rotary type, powdered coal furnace installation and a converter in operation. The moving picture was entitled "Modern Melting Methods" and illustrated cupola, powdered coal units including a quick anneal oven, and the steel converter. The operation of the cupola and the special charging equipment made by the company also was illustrated.

Displayed Opearting Model

Various types of materials handling equipment were on display. The C. O. Bartlett & Snow Co., Cleveland, showed an interesting operating model of an oval type mold conveyor as well as standard parts for conveyor systems. The Osborn Mfg. Co., Cleveland displayed light and heavy rail sections, trolleys of ¼, ½, 1, 2 and 3-ton capacities, a ½-ton electric hoist and a ½-ton chain hoist built in to special low headroom equipment. Photographs also showed the equipment and installations.

Link-Belt Co., Chicago, displayed colored photographs of sand conveyors, shakeout and mold conveyors at the pouring station, etc. The company also displayed a sand revivifying unit. The Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.,

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Give you the advantage of lower costs over your competitors when figuring cleaning costs of castings, forgings, etc.

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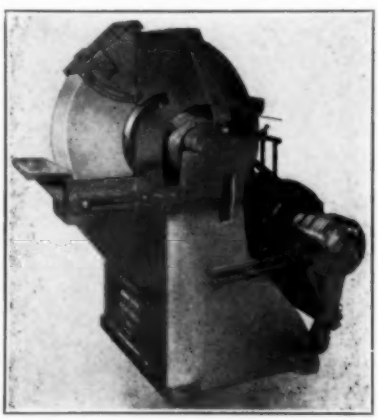

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A Facing and Core Binder That is Superior in STRENGTH, EFFICIENCY, ECONOMY

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Our experienced, practical foundrymen will prove MOGUL is all we claim for it.

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showed through photographs the application of its line of hoists and other types of handling equipment to foundry handling problems, including charging, ladle handling, pouring, stock yard handling, car moving, etc.

Cut-away models of electric truck parts and a hand operated lift truck were exhibited by the Yale & Towne Mfg. Co., Stamford, Conn., to show the working mechanism. The company also showed a 5-ton tramrail type chain hoist and a 1-ton electric chain hoist. The McCollum Hoist & Mfg. Co., Downers Grove, Ill., exhibited a number of electric hoists ranging in capacity from ¼ to 1-ton in capacity. Champion Pneumatic Machinery Co., Chicago, showed a line of small air compressors applicable to foundry work.

Core Oils on Display

Several firms manufacturing core oils had displays at the exhibition. The Quandt Chemical Co., San Francisco, exhibited samples of its core oil and a core mold wash. To show the various applications of the core oil, several types of castings using cores made with the oil were shown. Included in the display was a small aluminum piston which was jacketed. The core employed for the jacket is about 3/16-inch thick at the pin openings and tapers to practically a feather edge at the top and bottom. Werner G. Smith Co., Cleveland, had an attractively decorated booth with specimen cores and samples of its core oil on display. Smith Oil & Refining Co., Rockford, Ill., exhibited cores made with its oil. Swan-Finch Oil Corp., New York, displayed numerous cores employing core oil of its manufacture.

An interesting exhibit of various aluminum alloy ingots which it produces and showing their application in the form of castings made by the sand casting and permanent mold processes was displayed by the Apex Smelting Co., Cleveland. Fluxes made by the firm also were included. Ajax Metal Co., Philadelphia, showed ingots of the various copper-base alloys that it manufactures. Two large ornamental panels made of aluminum alloys were exhibited by William F. Jobbins Inc., Aurora, Ill. The display also included aluminum and aluminum alloy ingots, aluminum shot, aluminum hardeners. H. Kramer & Co., Chicago, showed sections of copper-base alloy ingots and shot that it manufactures.

U. S. Reduction Co., East Chicago, Ind., exhibited numerous aluminum and aluminum alloy ingots, and shot, and the background of its booth was composed of a variety of castings made from its alloys. Niagara Falls Smelting & Refining Co., Buffalo, had its booth fitted as a lounge for visitors. Vanadium Corp. of America, Bridgeville, Pa. displayed a large locomotive driving wheel made of vanadium steel. International Nickel Co., New York, exhibited several types of laboratory apparatus to show the relation between laboratory tests and commercial application of its products, and also showed a motion picture on the same subject.

Safety equipment for protection of men in pouring and cleaning castings was shown by a number of firms. Chicago Eye Shield Co., Chicago, displayed its new sandblast helmet. Standard Safety Equipment Co., Chicago, exhibited several types of head masks, gloves goggles, respirators and safety leggings. Willson Products Inc., Reading, Pa., included respirators, goggles and sandblast helmets in its display. Demonstrations were made of the application of its helmets and respirators. Safety First Shoe Co., Holliston, Mass., had its booth fitted as a lounge for visitors.

United Compound Co., Buffalo, displayed several sizes of the vent wax that it produces. Combined Supply & Equipment Co., Buffalo, showed various sizes and types of chaplets it supplies, cast aluminum pattern plates, a pneumatically operated core paster, dowels and dowel plates, and rapping plates. Chicago Mfg. & Distributing Co., Chicago, included in its display a wood flask and several sections to show the construction, a rubber tired core buggy, and a ladle buggy.

Black, Sivalls & Bryson Mfg. Co., Kansas City, Mo., showed a new, pressed steel flask and a section to indicate its construction. It also displayed a perforated steel bottom board. Smith & Richardson Mfg. Co., Geneva, Ill., exhibited hinge tubes, a variety of chaplets, and stove molding fittings for producing holes without cores.

Moltrup Steel Products Co., Beaver Falls, Pa., displayed representative specimens of the line of flat steel pattern plates, core plates, bottom boards that it manufactures. The exhibit also included cold drawn steel rounds, squares, hexagons, flats and special shapes for a variety of uses. Several different types of thermocouples and heat indicating meters were shown by the Illinois Testing Laboratories, Chicago, for use in measuring metal and oven temperatures.

Electro Refractories & Alloys Corp., Buffalo, exhibited crucibles, brick, and tile made from its refractory material. Stevenson, Jordan & Harrison, Chicago, had its booth fitted as a lounge for visitors.

George C. Isbester has become associated with the Yale & Towne Mfg. Co., Philadelphia division, and will direct the sale of hand and electric trucks and tractors to railroads in the Midwestern territory. He is located at 713 Railway Exchange building, Chicago.

Chicago Foundrymen Discuss Sand Problems

Sand mixing methods exert an important influence on mold properties, it was emphasized by Harry W. Dietert, Harry W. Dietert Co. and United States Radiator Co., Detroit, in an address before the Chicago Foundrymen's club at its monthly meeting June 1 at the Great Northern hotel. More than 50 members attended. Illustrating his talk with charts, Mr. Dietert presented the results of tests to determine the characteristics of various grades of sands when worked by different types of mixing machines.

The speaker pointed out that the most desirable properties are not imparted by the same machine to all grades of sands, thereby making a choice of mixing method dependent upon the type of sand employed and upon the mold character desired. Variations in mold hardness, in permeability of dry and green sand and in dry sand strength were depicted in use of several different mixing methods and sands. Permeability of the mold also varies with the depth of the cope, declining as the flask height is increased, while mold hardness decreases with a rise in the sand moisture content, it was stated.

Grain size was discussed in its relation to strength, permeability and face mold hardness, all three properties of which rise to a certain point with an increase in coarseness of the sand. A clay content also imparts hardness and strength, a chart showing gains in the latter two as the clay content is increased. This rising curve tends to flatten, however, with greater clay additions.

Discussing mold hardness variations at different depths of the pattern, Mr. Dietert illustrated the changes that occur when different ramming methods are employed. In squeeze ramming the hardness drops sharply near the flask plate, being greatest at the flask surface. Jolt ramming produces greater hardness at the base of the pattern but here too there is a marked decrease compared with the hardness at other points. While hand ramming eliminates this softness near the parting line, its use is not suitable for production work. In this connection Mr. Dietert mentioned the desirability of incorporating some form of a peen rammer in the usual types of ramming machines and stated that at least one manufacturer is planning such a development. The speaker also described various equipment used in testing sand molds.

This was the last meeting until October for the Chicago Foundrymen's club, although a boat trip to Michigan City, Ind., and return is scheduled for July 22.

A. S. T. M. Features Gray Iron

(*Continued from Page* 31)

for short time, high-temperature tension test of metallic materials.

Mr. MacKenzie presented an informal report of the sectional committee on specifications for cast iron pipe and special castings and stated the work has fair prospects of being completed on pit cast pipe by the end of the year. Papers presented at the meeting included "Creep and Structural Stability of Nickel-Chromium Iron Alloys at 1600 Degrees Fahr." by W. A. Tucker and S. E. Sinclair, bureau of mines, which was presented by H. S. Raudon of that department, and "Studies on the Modification of the Rohn Test for Investigating Creep of Metals," by C. R. Austin and J. R. Gier, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

New officers shown in the accompanying box, were announced at a general meeting held Monday evening, which included the presentation of various committee reports. K. G. Mackenzie, consulting chemist, the Texas Co., New York, and past president of the society presided. C. L. Warwick, secretary-treasurer of the society, in reporting for the executive committee pointed out that activities of the organization, particularly in regard to the number of standards which have been set up, have increased steadily over recent years despite the dropping off in membership since 1929, occasioned by business conditions.

The annual address by Retiring President Cloyd M. Chapman, consulting engineer, New York, entitled "Introspection," traced the various steps in industry which have resulted in the development of the materials testing society.

Adopt New Standards

Recommendations of various committees concerned with the establishment of standards for steel were given at the Tuesday sessions. New standards which were proposed and adopted as tentative measures cover specifications for alloy steel castings for structural purposes; and specifications for lap welded and seamless steel pipe for high temperature service; specifications for heat-treated carbon steel elliptical springs for railway equipment.

Revisions were recommended for 11 standard specifications covering cast, rolled and forged steel products, including cast valves, flanges and fittings. Nine standards, recently listed as tentative, were approved to be adopted as standard, while 13 tentative revisions of existing standards which were proposed last year were accepted as standard revisions.

A year ago it was proposed to refer to the bessemer process as the "acid-bessemer process" and it was recommended that this tentative revision be adopted as standard. Among other measures approved was the recommendation to submit specifications to the American Standards association for approval as American standard specifications covering carbon steel castings for valves, flanges and fittings for high-temperature service.

A reliable method of determining impact resistance on hard materials is greatly needed, it was pointed out in a paper on "The Torsion Impact Test," by G. V. Luerssen and O. V. Greene, Carpenter Steel Co., Reading, Pa. A machine and method especially adapted to hard materials, in which the specimen is fractured torsionally under impact, were described.

President Cloyd M. Chapman opened the Thursday morning session on fatigue of metals, testing and metallography by introducing as chairman Dr. Herbert J. Gough, National Physical laboratory, England, the Edgar Marburg lecturerer for 1933.

The report of the committee E-1 on methods of testing was presented by O. N. Fulweiler, chairman, and various subcommittees reported individually. A new proposed method of compression testing of metallic materials was adopted as tentative, while a new tentative method of verification of testing machines and of analysis for size distribution of subsieve size particulate substances also were accepted.

C. H. Davis, chairman of the committee on metallography presented tentative recommended practices for the thermal-analysis of steel and also a new grain size chart on classification of steel.

Test For Endurance Limit

A new "over night" test for development of endurance limit under the fatigue testing was presented by H. B. Wishart, graduate student, University of Illinois, Urbana, Ill., whose work had been carried on under Dr. H. F. Moore, research professor. The new test briefly requires five or six fatigue specimens upon which Rockwell hardness is determined. The specimens then are placed in rotating beam machines and subjected to approximately 1,400,000 cycles of stress. The specimens then are removed and pulled as tension specimens, noting the tensile strength, making corrections proportional to the Rockwell hardness, the test data are plotted with the number of cycles as ordinates and tensile strength as abscissas. The endurance limit is taken as the ordinate corresponding to the maximum abscissa of this curve. The method has been checked against long-run fatigue tests on structural steel, cold-rolled steel, brass, monel metal, nickel-steel, chromium nickel steel, duralumin and notched cold-rolled steel. The results obtained show a close approximation in the case of materials other than soft white metals.

R. L. Templin, chief engineer of tests, Aluminum Co. of America, New Kensington, Pa., observed that the "over night" test is not suitable for light metals inasmuch as metallographic if not actual chemical changes take place that impair short-time tests. Dr. Gough observed that hardening proceeds through the fatigue limit and that the latter is a variable.

A joint paper by Dr. Ancel St. John and H. R. Isenburger, St. John X-Ray Corp., New York, presented the conclusion that paper is preferable for industrial x-ray work.

Under chairmanship of F. F. Farnsworth, Bell Telephone laboratory, New York, an interesting session on corrosion resistance of metals

(*Concluded on Page* 71)

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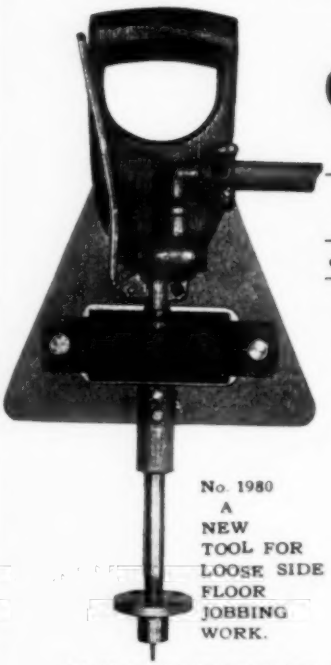

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(*Concluded from Page* 69)

was held Thursday afternoon. The committee on corrosion of iron and steel proposed new methods of determining the weight of coating on zinc-coated articles.

Influence of water velocity and time on the corrosion of iron was reported by Mr. Passano in a joint report prepared with F. R. Nagley of the American Rolling Mill Co. Completely immersed specimens were used, observed and cleaned at varying intervals. Initially, iron loses weight in proportion to time. The duration of the initial period decreases as the velocity of flow of the water is raised. Iron exposed to water at high velocity loses more weight for a constant time than that in low velocity flow. Hugh R. Evans, Cambridge University, England in a written discussion commented that over-all corrosion is less dangerous than localized corroding spots.

Report on Corrosion

In presenting the report of the committee on the corrosion of nonterrous metals, T. S. Fuller, chairman, told of tests on 25,000 of various nonferrous specimens exposed at widely separated points throughout the country to the action of the atmosphere. The specimens are in portable test racks and are returned to a central laboratory for observation. No cleaning is attempted on this long time test, but observations as to the changes in weight, physical properties and color are noted. The change in color was mentioned in the discussion with a word of caution to architects. The growth of application of nonferrous metals to building purposes, combinations of aluminum, brass, bronze and stainless steel, should induce study of the color resulting after a time due to corrosion effects.

Jerome Strauss, chairman of the committee on iron-chromium, and related alloys reported on tests being conducted on corrosion properties. A recommended practice on welding examinations is being prepared.

The report of the sectional committee on zinc coating of iron and steel, of which J. H. Capp is chairman presented proposed tentative specifications for hot-dip hardware and fastenings.

Many important developments in nonferrous metals were presented for consideration at the session Friday morning at which W. H. Bassett, American Brass Co., Waterbury, Conn., presided. E. E. Thum presented the report on nonferrous metals and alloys. Requirements for special high grade zinc specifying that it shall not contain more than 0.010 per cent lead 0.005 per cent iron and 0.005 per cent cadmium, and shall be free from aluminum were proposed. A new tentative method of chemical analysis for aluminum and light aluminum alloys was offered.

J. N. Kenyon, Civil Engineering Testing laboratories, Columbia university, presented a paper showing the effect of the addition of lead on hardness of tin base bearing alloys. Lead in the amount of 3 to 4 per cent added to three tin-base alloys increased the hardness of the material for temperatures up to 100 degrees Cent.

C. E. Swartz and A. J. Phillips, American Smelting & Refining Co., Maurer, N. J., presented a comparison of white metal bearing alloys containing tin with those containing cadmium at temperatures up to 300 degrees Cent., and interest in the latter series of alloys is increased due to the fact that cadmium is found in the United States, while tin alloy is produced abroad. The compressive strength of cadmium nickel-bearing alloys is greater at all temperatures, while the softening point is higher than is the case for tin-base babbits. In addition, the cadmium nickel alloys have a higher order of creep resistance and hardness is greater than at all temperatures studied. The cadmium nickel alloy, unlike other cadmium alloys, readily is bonded with steel as well as brass.

A test run was made with a six cylinder car, three connecting rod bearings, using cadmium bearings without backing and the other three using tin-base babbitt, bronze backed. At the end of 62,500 miles the tin base bearings had melted while the cadmium bearings were in suitable condition to be replaced for additional service. Intense study is being devoted to the subject of bearing metals due to the fact that modern automobiles of the high compression type develop stresses up to 20,000 pounds per square inch and operate at temperatures up to 200 degrees.

Changes were proposed in the standard specifications for composition brass or ounce metal for sand casting. These increased the maximum copper content to 86 per cent and reduced tin, lead and zinc to 5.5 per cent maximum in each instance, while the premissible maximum of phosphorus and nickel was lowered.

Change the Specifications

The standard specifications for yellow brass sand castings are recommended for revision with maximums as follows: Copper 67 per cent; tin 1.5 per cent; lead 4.0 per cent; and with phosphorus, zinc and antimony lowered. The permissible content of nickel in increased to 0.5 per cent maximum.

After recess Sam Tour, Lucius Pitkin & Co., New York, presided. H. B. Gardner, joint author with C. M. Saeger Jr., bureau of standards, presented a paper on the effect of sulphur and iron on the properties of red cast brass. This brass containing 85 per cent copper with 5 per cent each of tin, zinc and lead gives the best results on test bars poured at 2100 degrees Fahr. The pouring temperature has a marked influence on tensile strength, hardness, electrical resistivity and density of sand cast bars. Alloy containing sulphur up to 0.1 per cent and iron up to 0.6 per cent meets present requirements and the running qualities of the alloy are improved by these small additions. Proposed revised tentative specifications for zinc-base alloy die castings were offered.

Progress

ENGINEERS' DAY, June 28, at A Century of Progress, Chicago, marked the climax of a week which witnessed one of the most notable and largest gatherings of engineers in history. Members of various associations and societies which had been holding separate meetings during Engineers Week joined in the observance of the event.

Highlights of the morning program was the presentation of the Daniel Guggenheim medal, the year's award for the most notable achievement in aviation, to Juan de la Cierva, inventor of the autogyro. Before an audience of more than 2000 assembled in Soldiers Field stadium Don Cierva landed in a plane of his design to receive the award.

The engineering societies banquet that evening at the Stevens hotel completed the day's program. Harry B. Gear, president, Western Society of Engineers, president Edward J. Mehren, president, Portland Cement association, spoke on "Contribution of Engineering to Progress—A Review and Evaluation." "Science and Engineering" was the subject of an address by Dr. Karl T. Compton, president, Massachusetts Institute of Technology.

Appointed Agent

McVoy-Hausman Co., Brown-Marx building, Birmingham, Ala., has been appointed district sales agent of the Foundry Equipment Co., Cleveland. The McVoy-Hausman Co. is a new partnership combining the sales agency formerly known as James L. McVoy and the Hausman-Harwick Machine Tool Co.

Plan Organizations and Codes

(*Concluded from Page* 24)

As he accepted the chair, a vote of thanks and appreciation for his work in connection with assisting the industry to meet, the requirements of the industrial control regulation was adopted unanimously.

Mr. Lorenz outlined the requirements of law and the rulings of the administrator. He advised preparation of a code which will be undertaken at once by the executive committee previously mentioned. It then will be referred to each geographical group for consideration of every member. He invited all steel foundrymen to affiliate with the society and announced that the initiation fees have been waived for a limited period.

The first action, it was stated in discussion, will be to provide a general code dealing specifically with the labor and employment angles. Later a schedule of costs is planned with a basic index covering labor and materials, by which these costs may be adjusted up or down in accordance with prevailing business conditions.

Nonferrous Group Meets

Keen interest in the application and operation of the national Industrial recovery act as affecting nonferrous foundries, was displayed at a meeting held Friday afternoon Dan M. Avey, THE FOUNDRY, Cleveland, speaking in behalf of the A. F. A. called the meeting to order and explained its purpose. The chairman introduced C. E. Hoyt executive secretary of the A. F. A. who outlined the position of the A. F. A. with regard to foundries and the act. He said the association was concerned with technical phases of the foundry industry, and that the problems with which the national industrial recovery act are concerned will have to be dealt with by each branch of the foundry industry. N. K. B. Patch, Lumen Bearing Co., Buffalo was elected to serve as temporary chairman with J. L. Wick Jr., Falcon Bronze Co., Youngstown, O., as secretary. Mr. Patch, then called upon James B. Wescott who presented a brief synopsis of the national industrial recovery act, and outlined its probable operation.

After some discussion from the floor on whether the nonferrous foundries should organize as such or join a foundry group already functioning, W. E. Paulson, Thos. E. Paulson & Son Inc., Brooklyn, N. Y., made a motion that a nonferrous foundry group be organized. The motion was seconded and carried unanimously. E. J. Zasier, Ampco Metal Co., Milwaukee, then made a motion that the chairman appoint a committee of five to act as an organizing body. That was carried, and another motion was made that Mr. Patch and Mr. Wick act with the committee of five. That motion also was carried unanimously.

Following a recess of about one-half hour Mr. Patch announced that he had appointed the following to act as the organizing commiteee: H. W. Holt, Bohn Aluminum & Brass Corp., Detroit; G. B. Miller, Loeffelholz Co., Milwaukee; F. L. Hayes, Chicago Hardware Co.; North Chicago, Ill.; F. S. Wellman, Wellman Bronze Co., Cleveland, and W. E. Paulson, Thos. E. Paulson & Son Inc., Brooklyn, N. Y.

Establish Ten Districts

Organization work of the Nonferrous Foundry Association for Industrial Recovery is proceeding under direction of the committee. A form of tentative proposed by-laws setting up ten districts is provided and organization meetings will be held as rapidly as possible. Sam Tour, Lucius Pitkin Co., New York, is acting as secretary and James B. Wescott, Chicago, as counsel of the organization.

Various districts and chairman appointed to call the organization meetings are as follows: District No. 1—E. H. Ballard, General Electric Co., Lynn, Mass.; District No. 2—W. E. Paulson, Thomas Paulson & Sons Inc., Brooklyn, N. Y.; District No. 3—N. K. B. Patch, Lumen Bearing Co., Buffalo, N. Y.; District No. 4—F. S. Wellman, Wellman Bronze & Aluminum Co., Cleveland, O.; District No. 5—H. W. Holt, Bohn Aluminum & Brass Corp., Detroit, Mich.; District No. 6—Frank L. Hayes, Chicago Hardware Foundry Co., North Chicago, Ill.; District No. 7—George B. Miller, Loeffelholz Co., Milwaukee, Wis.; District No. 8—C. Wegelin, Dixie Brass & Foundry Co., Birmingham; District No. 9—E. J. Thomas, Progressive Brass Mfg. Co., Kansas City, Mo.; and District No. 10—C. Hoehn, Enterprise Foundry, San Francisco, Calif.

Gray Iron Industry Committee of Seventeen

Mass.-R. I.
E. H. Ballard, General Electric Co., Lynn, Mass.

Conn.
*F. R. Hoadley, Farrel-Birmingham Co., Ansonia, Conn.

Metropolitan
J. L. Carter, Montclair, N. J.

Philadelphia
B. H. Johnson, R. D. Wood & Co., Philadelphia.

Niagara Frontier
R. E. Dillon, Lake Erie Engineering Corp., Buffalo.

Pittsburgh
H. P. Spilker, Sterrit-Thomas Foundry, Pittsburgh.

Michigan
Fred Erb, Eaton-Erb Foundry Co., Detroit.

Northern Ohio
*W. L. Seelbach, Forest City Foundries Co., Cleveland.

Southern Ohio
*A. H. Kramer, Advance Foundry Co., Dayton, O.

Southern
George M. Morrow Jr., Goslin-Birmingham Mfg. Co. Inc., Birmingham, Ala.

Chicago
*C. B. Magrath, Greenlee Foundry Co., Chicago.

Minnesota
E. G. Monson, Central Machine Works Co., Minneapolis

Wisconsin
W. J. Grede, Liberty Foundry Co., Wauwatosa, Wis.

Quad Cities
John H. Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa.

St. Louis
*William T. Mellow, Liberty Foundry, St. Louis.

Texas
A. E. Hartwell, Hartwell Iron Works, Houston, Tex.

West Coast
Charles Hoehn, Enterprise Foundry Co., San Francisco.

*Steering Committee of Five

The committee requests all gray iron foundries not contacted to communicate with their respective local chairmen or with the Gray Iron institute, 4300 Euclid avenue, Cleveland.

Book Review

Heat and Its Workings, by Morton Mott-Smith, cloth, 240 pages 5 x 7½ inches, published by D. Appleton & Co., and supplied by THE FOUNDRY, Cleveland, for $2.00, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This interesting book presents fundamental information on the theories of heat, its physical properties, experiments made with it, conclusions drawn and laws formed. The author has prepared the text in nontechnical language and popular style. Information covered included the expansion of bodies, the perfect gas, calories, change of state, evaporation, effects of pressure, real gases, solutions, convection and conduction, and radiation.

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Foundrymen's Handbook

Table of Contents

Section I.	General Foundry Data	Section IV.	Nonferrous Metals and Alloys
Section II.	Computing Weights		
Section III.	Reference for Pattern Makers	Section V.	Specifications
		Section VI.	Miscellaneous Tables

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Obituary

JAMES R. McWANE, president of the McWane Cast Iron Pipe Co., Birmingham, Ala., and an affiliated company the Pacific States Cast Iron Pipe Co., Provo, Utah, died Saturday June 24 in a hotel in Chicago where he had arrived a week previously to attend several conventions including that of the American Foundrymen's association and the American Water Works association. Prominently connected with the cast iron pipe industry for many years he was most widely known as the inventor of a process for casting 18-foot lengths of pressure pipe horizontally in green sand molds, with green sand cores and without the use of chaplets. Mr. McWane was born in Wytheville, Va., Aug. 15, 1869, the son of Charles Phillip and Eliza Hoge (Dudley) McWane. He was educated at Milligen college and Transylvania university and was graduated with an A. B. degree from Bethany college, West Virginia in 1891. After an association with his father and brothers in the McWane Plow Works, he served from 1896 to 1903 as president of the Lynchburg Plow Co., Lynchburg, Va. He moved to Birmingham, Ala., in 1903 and established the American Steel Casting Co. In 1907 he joined the American Cast Iron Pipe Co., Birmingham, as vice president and later was elected president. In 1922 he resigned his position to organize the McWane Cast Iron Pipe Co., and to manufacture pipe according to a method which differed radically from those already in use. During the war he served as a Major in the ordnance department. He also served as staff assistant to the vice president of the Emergency Fleet Corp., during the latter part of the war.

Arthur E. Baker, 76, president Baker Bros. Inc., Toledo, O., died June 2. Mr. Baker became connected with that company in 1882.

T. G. Bush, Jr., general manager, Sommerville Iron Works, Chattanooga, Tenn., died June 6. He was a son of the late T. G. Bush, pioneer industrialist of Birmingham, Ala.

D. L. Sattenstein, secretary in charge of purchases, H. Kramer & Co., Chicago, died June 25. Mr. Sattenstein had been associated with the Kramer company for the past 38 years.

Edward J. Griffin, 57, for 20 years chief engineer of Mesta Machine Co., Homestead, Pa., died at Pittsburgh, June 12. Mr. Griffin was born in Laurenceville, Pa., and had lived in Homestead since 1903.

W. C. Lytle, recently representative at Chicago for the Pittsburgh Crushed Steel Co., Pittsburgh, and for about 20 years associated with the Pangborn Corp., Hagerstown, Md., as salesman and sales manager, died in Chicago recently. Mr. Lytle was well known throughout the foundry industry.

Richard Bigley, 77, one time a leader in the foundry industry in Toronto, Ont., died recently. Mr. Bigley began the patternmaking business for himself in 1875. This developed until he had one of the most important foundries in that city, manufacturing stoves, furnaces, water fittings and pipe. He retired in 1926.

T. Coleman Ward, president, Hickman-Williams & Co., Pittsburgh, died recently. Mr. Ward was born in Louisville, Ky., and early became identified with his father in the old Birmingham Rolling Mills Co., Birmingham, Ala. At one time he was affiliated with the Sloss-Sheffield Co., Birmingham, and in 1903 became connected with Hickman-Williams & Co., where he has remained ever since.

James R. McWane

Elijah W. Hodge, 89 founder of the Hodge Mfg. Co., died in Greenville, Pa., June 4. Mr. Hodge was born June 9, 1843 in Eastington, Gloucestershire, England. In early life he started work in English woolen mills, and emigrated to Greenville, Pa., in 1868, where he took a position in the Hamblin & Son Co. foundry, and worked for the next 7 years as a molder. In 1876, he built a small brass foundry in a shop which a short time later became the Hodge Brass & Iron foundry, and in 1883, the Hodge Mfg. Co. Mr. Hodge was active in civic enterprises.

James A. Shepard, 69, vice president and consulting engineer, Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y., died June 10 at his summer home, Kayutah Lake, N. Y. In 1880, in partnership with his father and brother, Mr. Shepard established a foundry and machine shop in Montour Falls under the name of W. H. Shepard & Sons, for the production of agricultural implements and special castings. Several years later the name was changed to the Havana Bridge Works and the company engaged in the fabrication and building of steel bridges and structural steel work. In 1903 Mr. Shepard founded the General Pneumatic Tool Co. which later became the Shepard Electric Crane & Hoist Co. Several years ago that company purchased the Sprague Electric Hoist Co. and the Niles Crane Co. and reorganized under the title, Shepard Niles Crane & Hoist Corp.

Book Review

Bookkeeping and Cost Accounting in the Iron and Steel Foundry (Betreibsbuchhaltung und Kostenrechnung in der Eisen-und Stahlgiesserei), by A. Geissel, paper or cloth, 136 pages, 6¼ x 9¼ inches, published by Wilhelm Knapp, Halle (Salle), Germany, and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This book is part 17 of a series on works practice in iron, steel and metal foundries edited by Hubert Hermanns, and is printed in German. It is divided into four parts. The first section deals with the foundation or basic principles and discusses the structure of costing, value of materials, wages, and expenses. The second part relates to the structure of cost accounting or methods employed, and includes information on the determination of costs through orders, checking the materials, wages, good castings, produced, and pattern cards. The third part deals with the account or departmental plan whereby the various materials, and operations are divided into separate accounts, and the charges are made according to distribution. The fourth section discusses estimating costs for bidding purposes.

Business Sets Record

Superior Charcoal Iron Co., Grand Rapids, Mich., reports that the sale of charcoal iron during May was the largest of any month during the past two and one-half years. Shipments also were considerably heavier than in any month during the same period.

The 1933 convention of the Association of Iron & Steel Electric Engineers will be held in Pittsburgh, Oct. 17, 18 and 19. Convention plans include an Iron and Steel exposition at the William Penn hotel, where the newest developments in steel mill equipment will be displayed.

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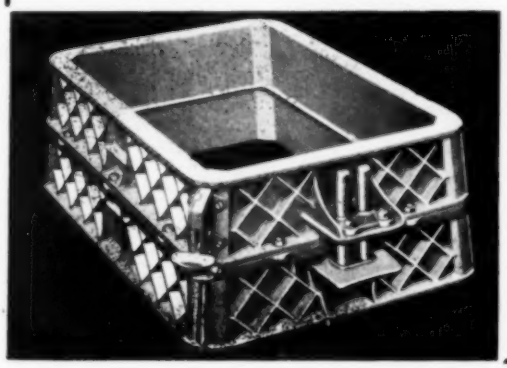

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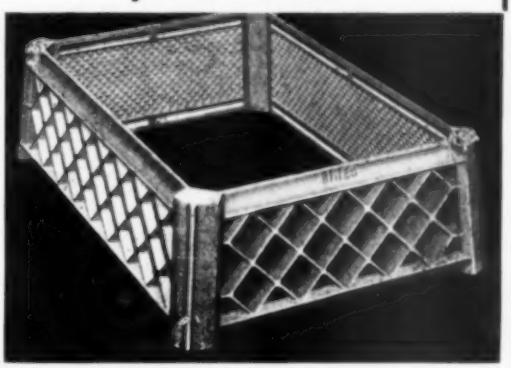

American Malleable Cast Iron

By H. A. Schwartz

This book is the first complete treatise on "black hearth" malleable iron ever published.

It covers the history of the malleable industry—its development, modern methods of manufacture, metallurgical principles involved and the properties and uses of American malleable cast iron. It also includes a detailed bibliography in which all the important books and articles published pertaining to malleable iron are listed and represents the only reference work available on the subject.

While written primarily for the producer and user of malleable castings, this book is also adapted to the needs of the technical student and the library.

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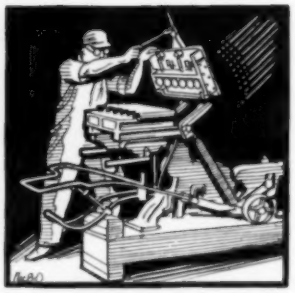
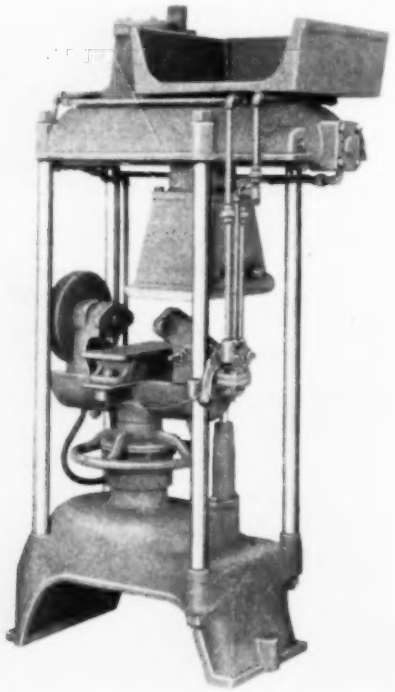
New Equipment



For Foundries

Single Valve Controls Core Blower

International Molding Machine Co., 2608 West Sixteenth street, Chicago, has introduced a new core blowing machine designed to have a capacity for cores up to 25 pounds.



Operating valve controls sequence of operations

Features of the machine are rugged construction and the absence of complicated mechanisms. The operating valve controls the complete sequence of operatfons through one full movement of the lever. This moves the sand container into position, clamps the box, blows the sand, unclamps the box and moves the container back. The main blower valve is designed to prevent leakage and is of the poppet type with flat leather seat. The table of the machine is of steel and may be removed and replaced quickly when a change of core box makes that operation necessary.

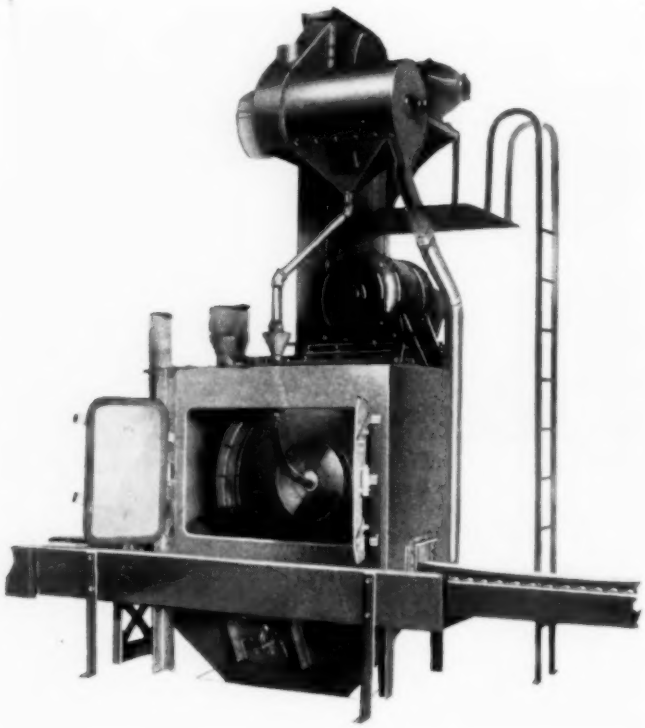
The clamps are rigid and arranged to provide parallel clamping surfaces on the core box. The core blower plates through which the sand is blown, fit rigidly on the container but may be changed quickly when plates having a different arrangement of outlet holes are required. The screw on which the hand wheel is mounted for adjusting the height of the table is enclosed completely to keep out dust and dirt. The machine may be supplied with or without a safety lock, according to the preference of the user.

The machine is constructed in small, medium and large sizes. It is supplied with a standard sand container and a core blower plate to blow a box having a core surface up to 7 x 14 inches. A larger or smaller sand container may be supplied if required. When used with clamps, the machine will accommodate a box 11 inches outside width. If the clamps are not needed, they may be removed and the width of the box increased to a corresponding extent.

Cleaning Device Operates Centrifugally

American Foundry Equipment Co., Mishawaka, Ind., recently has introduced a new method of cleaning for the metalworking field. The mechanical device which handles the abrasive and throws it against the work to be cleaned, is said to operate by centrifugal, tangential and aerodynamic forces. The results obtained by the device are due to the special arrangement of elements in the device itself.

The new method of cleaning is accomplished by the device shown installed in the accompanying illustration. Abrasive suited to the work is fed by gravity from a storage hopper into the centrifugal device. From this specially designed and constructed wheel, abrasive is ejected and cleans the work which passes underneath. The unit is extremely simple and requires a 10 horsepower



The new cleaning device may be installed in various types of blasting units

motor which is an integral part of the machine.

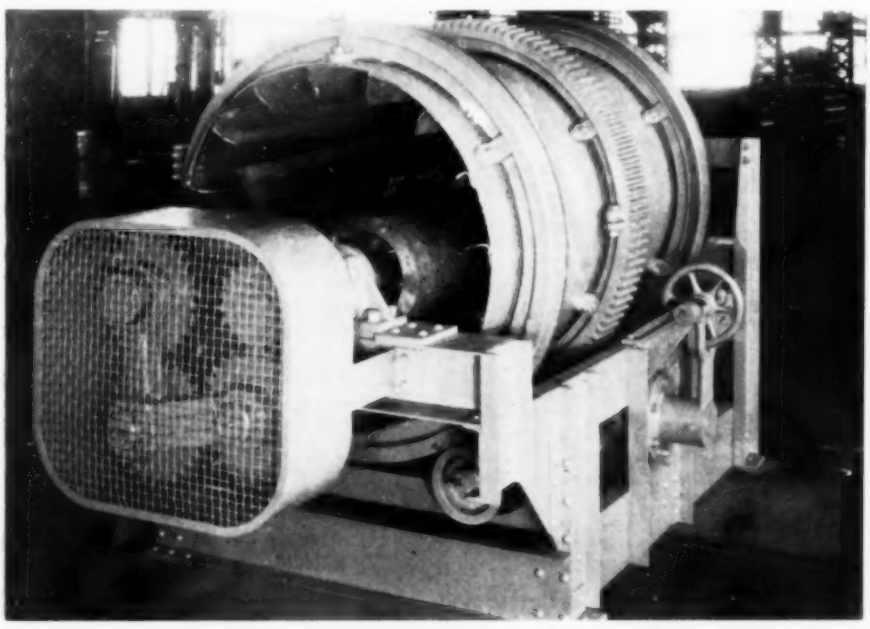
The new mechanical device may be used on the continuous type tumbling blast unit, or on the room, cabinet and table installations.

Continuous Mixer Has Control Feature

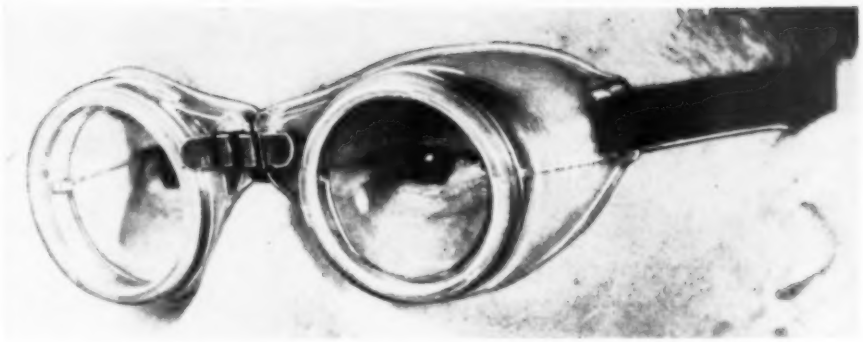
Standard Sand & Machine Co., 549 West Washington boulevard, Chicago, recently has introduced a continuous type sand blending machine. The new unit is a development from the continuous roll mixer made by that company, and has a number of added features for handling and conditioning sand in continuous operation. One of the interesting features is the introduction of mechanism for the control of volume and mixing time.

The new blending machine consists of a revolving drum fitted with lifting flights. Sand is delivered in a hopper at one end of the drum and is lifted and dropped on a pair of rolls progressively as it proceeds through the drum. These rolls are fitted with broad scrapers, forming a hopper, so that all of the sand is directed through the rolls. The rolls revolve toward one another at different speeds thus affording a slipping or rubbing action on the sand as it is squeezed through the rolls. The drum is mounted on a heavy cradle with hand wheel control so that the inclination of the drum can be changed to increase or decrease the volume and mixing time. This control feature is said to be a new development in continuous mixing methods and is used within a volume range of 20 to 40 tons of sand per hour. It may be applied while the machine is in operation.

The machine is of simple construction and all operating parts are readily accesible. It is fitted with self-aligning roller bearings with piston ring seals. Weight of the machine, exclusive of drive, is approximately 16,000 pounds. A 15 horsepower motor is specified for foundry operation under load.



The blending machine consists of a revolving drum fitted with lifting flights



The standard goggle can be used with or without spectacles

Transparent Cup Used in New Goggle

Willson Products, Inc., Reading, Pa., recently has introduced a new transparent cup goggle for industrial use. The transparent material enables the wearer to perceive objects through the cup. Light passes through the walls of the cup undimmed and permits a normal eye condition and adds visual comfort to the wearer.

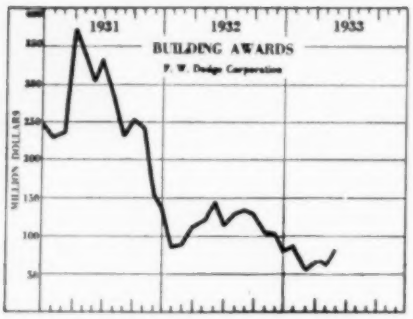
It is claimed that the goggle is sturdy, has strength to withstand impact is spark proof and extremely light in weight. The goggle is designed with sufficient room for comfort, is well ventilated and at the same time is extremely light in weight. The standard goggle can be used equally well with or without spectacles, therefore eliminating the necessity of carrying special replacement parts for two different styles of goggles.

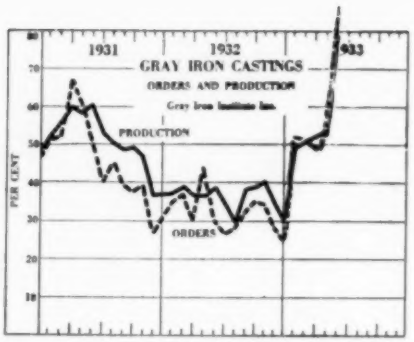
Device Controls Action of Pyrometer

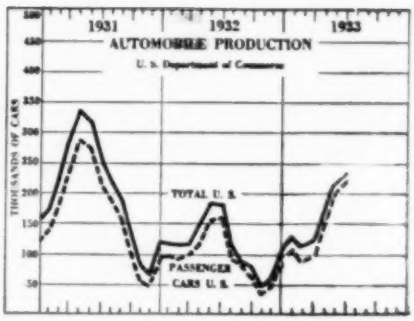
Anticipatory control action may be obtained with any pyrometer controller by adding a new device developed by the Foxboro Co., Foxboro, Mass. The unit is a cut-in between the thermocouple and the controller. In operation, the instrument impresses into the thermocouple circuit a slight additional E. M. F. that augments the thermocouple E. M. F. when the temperature is low and opposes it when the temperature is high. This causes the controller to close either the high or low circuit a little ahead of actual temperature demand. It is pointed out that adjustment to requirements of the particular heating equipment on which the unit is installed may be made quickly and easily. It may be installed on any blower and is capable of compensating for pressure, temperature and barometric changes.

Radial Pumps for Generating Pressure

Hydraulic Press Mfg. Co., Mt. Gilead, O., has developed a new series of radial pumps for generating pressure in operating hydraulic powered machinery. The pump is of the positive displacement, multiple radial plunger, oil pressure type in which a number of new features are incorporated. The output is variable in volume and reversible in direction of flow. The pumps are built in six sizes ranging from 1 gallon per minute to 100 gallons per minute with pressure capacities up to 3000 pounds per square inch.







Foundry Activities

Reflect Industrial Trends

FEDERAL MALLEABLE CO., 805 South Seventy-second street, Milwaukee, recently resumed production after being idle 14 months. Accumulation of orders from agricultural implement, railway equipment and general machinery and other types of builders has assured at least 2 months' production.

* * *

National Electric Welding Machines Co., Bay City, Mich., recently has been organized to succeed the Valley Castings & Pattern Co. The company will manufacture a line of welding equipment and will maintain a foundry and pattern department to care for the business formerly handled by the Valley Castings & Pattern Co. Edward C. Smith is president of the new company; J. R. Brueckner, vice president in charge of sales; Charles E. Shearer, secretary treasurer; William Mueller, works manager; and Howard Cogan, chief engineer.

* * *

West Michigan Steel Foundry Co., Muskegon, Mich., has taken over the management of the Eagle Foundry & Machine Co., 1208 West Western avenue, Muskegon. F. A. Backstrom, vice president and general manager of the Eagle Foundry Co., has resigned.

* * *

Quaker City Foundry Co., Salem, O., has purchased the foundry department of the former Silver Mfg. Co. from the Mullins Mfg. Corp. The foundry has been occupied by the Quaker City company since its organization following the closing of the Silver company.

* * *

Wisconsin Gray Iron Foundry Co., which recently burned, has leased the old Case Foundry in West Allis, Wis. It is reported that the company is considering the installation of an electric furnace for gray iron. John A. Burke is president of the company.

* * *

Decatur Casting Co., Decatur, Ind., a branch of the Hamilton Foundry & Machine Co., Hamilton, O., is operating six days and six nights a week with a full force. Business has been increasing for the past 2 months.

* * *

Western Gas Construction Co., Fort Wayne, Ind., Thomas W. Stone, vice president and general manager, is considering production of water valves on an extensive scale. This will necessitate the expansion of its valve department to three or four times the previous output.

* * *

Holland Furnace Co., Holland, Mich., has increased operations from a three to a six-day week basis, with one eight-hour shift daily. C. H. Landwehr is president and Arthur W. Wrieden is secretary of the company.

* * *

Delco-Remy Corp., Anderson, Ind., which was described in the May issue of THE FOUNDRY, is reported working six of its circular type machines two shifts a day and producing castings at the rate of 1,000,000 pieces a month.

* * *

Claffey Casting Co., Waukesha, Wis., recently was incorporated to operate a gray iron foundry. Equipment is being installed for light and medium weight production work. B. D. Claffey is president and general manager.

* * *

Peerless Foundry Co., 1853 Ludlow avenue, Indianapolis, recently has developed a blower which is attached to domestic furnaces to circulate and filter the air. T. J. Cornwell is president of the company.

* * *

Columbia Foundries, Columbia City, Ind., recently has been organized to take over the property formerly occupied by the Columbia Iron Works. The plant was scheduled for operation early in July.

* * *

Pittsburgh Steel Foundry Corp.,

RAW MATERIAL PRICES
June 5, 1933

Iron	
No. 2 foundry, Valley	$15.50
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	16.00
No. 2 foundry, Buffalo	16.00
Basic, Buffalo	15.50 to 16.00
Basic, Valley	15.00
Malleable, Chicago	16.00
Malleable, Buffalo	16.50
Coke	
Connellsville beehive coke premium	$4.00
Wise county beehive coke	3.00 to 4.25
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$12.00 to 12.50
Heavy melting steel, Pitts	11.50 to 12.00
Heavy melting steel, Chicago	9.00 to 9.50
Stove plate, Buffalo	8.75 to 9.00
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	5.50 to 6.00
No. 1 cast, Chicago	8.75 to 9.25
No. 1 cast, Pittsburgh	10.00 to 11.00
No. 1 cast, Philadelphia	10.00 to 11.00
No. 1 cast, Birmingham	7.50 to 8.50
Car wheels, iron, Pittsburgh	11.00 to 11.50
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	10.50 to 11.00
Malleable, Buffalo	11.00 to 12.00
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.25
Straits tin	46.50 to 46.75
Aluminum, No. 12, producers	19.00 to 22.00
Aluminum, No. 12 remelt Cleveland	12.00 to 12.50
Lead, New York	4.30
Antimony, New York	6.50
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.60

Pittsburgh, recently increased operations to slightly over 50 per cent, as compared with an average operating rate of around 10 per cent during the past 2 years.

* * *

Joseph Reid Gas Engine Co., Oil City, Pa., has increased operations to a basis of approximately 50 per cent of capacity to fill increased orders from the East Texas and Oklahoma oil fields.

* * *

Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., has moved its general offices from No. 2 plant on Sanford street, Muskegon Heights, to No. 3 plant on Henry street.

* * *

Gorham Mfg. Co. has placed its bronze division on a full 24-hour basis. The rate of activity is expected to continue for several months in view of the volume of business now on hand.

* * *

Chain Belt Co., Milwaukee, recently started a second melting furnace. The company has been operating one furnace five days a week, and reports a backlog of orders sufficient to justify the second furnace.

* * *

Buffalo Pipe & Foundry Co., Buffalo, has reopened its cast iron pipe foundry, Medina, N. Y., after a year of idleness. Ralph R. Rabe is vice president in charge of operations.

* * *

U. S. Hoffman Machinery Corp., Syracuse, N. Y., now is operating five days a week after being closed down one week each month during the past year.

* * *

Bingham & Taylor Corp., 575 Howard street, has increased production to 50 per cent during the last two months. Joe H. Gardner is president.

* * *

Shank Hardware Foundry Corp., Akron, Ind., has been incorporated by Gomer L. Shank, John Lockerbie, M. Ebbo and Raphael F. Quarrandille.

* * *

Willapa Harbor Iron Works, South Bend, Wash., will rebuild its foundry building, recently burned. Dan Coulter is manager.

* * *

Waltham Foundry Co., Felton and Water street, Waltham, Mass., recently was damaged by fire to the extent of $15,000.

* * *

Fisher Brass Co., Marysville, O., is erecting an addition 36 x 72 feet to provide an increase in capacity for the production of plumbing supplies.

* * *

Foundry and plate shop, Finch Mfg. Co., Scranton, Pa., recently was damaged by fire to the extent of $125,000.

* * *

Hoosier Iron Works, North Webster street, Kokomo, Ind., has increased operations to a five-day week basis to handle an increase in orders.

* * *

Foster, Merriam & Co., 31 Cross street, Meriden, Conn., will rebuild its foundry and adjacent unit, recently burned, at a cost of $40,000.

* * *

American Foundry Co., Indianapolis, is increasing its employe personnel to about 300 men. A substantial increase in orders is reported.

* * *

Titus Foundry Co., Coldwater, Mich., recently has been incorporated by Thurlow W. Titus.

* * *

Alloy Foundry & Signal Co., Saginaw has been incorporated to manufacture signal and electrical devices.

* * *

Schonert Foundry, Coal City, Ill., recently reports an increase in business. John Schonert is proprietor.

* * *

Dalton Foundries Inc., Warsaw, Ind., has increased wages 10 per cent. A. E. Morgan is president.

New Trade Publications

PATTERN COMPOUND.—A bulletin of the Tamms Silica Co., foundry division, 228 North LaSalle street, Chicago, discusses a compound for manuafcturing patterns and match plates. The material is provided in powdered form and mixes readily with water. The bulletin illustrates several match plates produced from the material, as well as a demountable frame designed especially for use with the product, eliminating the necessity for a separate frame for each pattern.

WELDING.—Linde Air Products Co., 30 East 42nd street, New York, has published a catalog "Oxwelding for General Maintenance" describing the use of the oxyacetylene process of welding and cutting. A chart showing simple tests for identifying metals also is included.

ELECTRICAL EQUIPMENT—General Electric Co., Schenectady, N. Y., recently has issued several bulletins including those devoted to steam turbines for mechanical drive, lead-sheathed immersion units for heating corrosive baths, low speed alternating-current generators, and totally enclosed squirrel-cage motors.

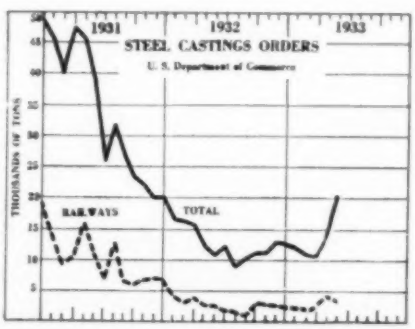
RUBBER LINING—A rubber compound for lining rotary grinding mills is described in a recent publication of the B. F. Goodrich Rubber Co., Akron, O. This compound, it is claimed, combines toughness and resiliency with an exceptional capacity to resist abrasive wear. The booklet discusses functions and applications of the rubber compound and presents pictures, diagrams and layouts of installations.

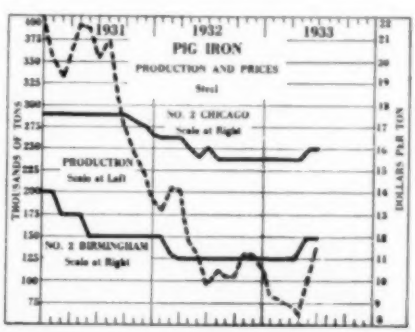
ELECTRIC FURNACE.—The use of the rocking type electric furnace in the manufacture of gray iron, malleable iron, alloy steel and nonferrous metals is described in a recent bulletin of the Detroit Electric Furnace Co., 825 West Elizabeth street, Detroit. The service supplied by that organization also is discussed.

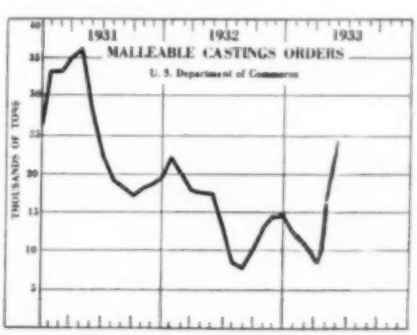
AIR DRIERS.—James A. Murphy Co., Hamilton, O., has published a bulletin on its line of separators, aftercoolers and automatic traps. The aftercooler and separator have been designed to provide complete removal of moisture from compressed air which may be used in connection with the sandblast, molding machines, vibrators, etc.

WELDING EQUIPMENT—Hobart Bros. Co., Troy, O., has published a bulletin describing and illustrating its line of electric welding equipment designed for a variety of purposes.

ABRASIVE SLEEVES.—Cleveland Container Co., abrasive division, 10730 Berea road, Cleveland, has published a bulletin illustrating and describing its abrasive sleeves and expanding polishing wheels. The equipment is designed for use with portable grinders.







Classified Ads

Help Wanted

EASTERN STEEL FOUNDRY WOULD LIKE to communicate with man suitable to take position of foreman of molding and core room. He must be qualified to originate the most modern and economical methods of machine and floor molding; possess a knowledge of sand control and have good recommendations from nationally known foundries on similar classes of work. Address Box 724, THE FOUNDRY, Cleveland.

WANTED

Experienced steel foundry bench foreman, for large mid-west steel foundry. Address Box 727, THE FOUNDRY, Cleveland.

WANTED FOUNDRY SUPERINTENDENT

To take complete charge and be able to invest from $5000 to $10,000. Man must be up-to-date on production. This is a real opportunity to make money for a high class man. Do not answer this ad unless you have ability and can invest. Immediate action. Address Box 732, THE FOUNDRY, Cleveland.

WANTED

Experienced man in twenties or thirties for small gray iron foundry in Indiana. Must be expert core maker and molder on bench, floor and squeezer. Competent to become working foreman. Splendid opportunity for industrious young man. Address Box 730, THE FOUNDRY, Cleveland.

Employment Service

IF YOU ARE OPEN TO OVERTURES FOR new connection, and qualified for a salary between $2500 and $25,000, your response to this announcement is invited. The undersigned provides thoroughly organized service of recognized standing and reputation, through which preliminaries are negotiated confidentially for positions of the calibre indicated. The procedure is individualized to each client's personal requirements; your identity covered and present position protected. Established twenty-three years. Send only name and address for details. R. W. Bixby, Inc., 101 Delward Building, Buffalo, N. Y.

ATTENTION FOUNDRY OWNERS

Write or wire us for technically-trained practical foundry foremen, superintendent, production managers, chemists, metallurgists, core foremen, cost clerks, salesmen, patternmakers, melters (electric, open-hearth, converter and cupola.) No charge. Licensed Agency, McLAIN'S SYSTEM, INC., 804 Goldsmith Bldg., Milwaukee, Wis.

Positions Wanted

GRAY IRON FOREMAN

or superintendent on work from 1 lb. to 50 tons. Specialized heavy machine castings. Mix by analysis. Many years experience as molder foreman and superintendent. Address Box 567, THE FOUNDRY, Cleveland.

GRAY IRON FOREMAN

25 years experience. Large and small fittings, machinery, general jobbing. Twelve years foreman two largest shops Birmingham, Alabama. References from both. Address Box 709, THE FOUNDRY, Cleveland

GRAY IRON SUPT. OR MANAGER

Thoroughly experienced in all branches of foundry practice. Twenty-five years experience in responsible executive positions. Excellent references. Address Box 684, THE FOUNDRY, Cleveland.

FOUNDRY SUPERINTENDENT

25 years proven ability. Grey iron, semi-steel, nickel alloy iron. Skilled molder. Experienced foreman, superintendent, metallurgist. Technical experience. Good organizer. Demonstrated ability in cost reduction and production of quality castings. Mix iron by analysis. Expert cupola practice. Address Box 702, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR FOREMAN

Age 40. Technical and business education, also practical experienced foundryman. Gray iron, semi-steel, alloyed iron castings. Jobbing or production. Mix by analysis. Address Box 701, THE FOUNDRY, Cleveland.

SCOTSMAN

Desires position as iron-moulder. Good practical all-round mechanic on marine and machine tool castings. A.1. as trouble-shooter. Best references. Address Box 721, THE FOUNDRY, Cleveland.

Positions Wanted

ATTENTION

OHIO AND MICHIGAN FOUNDRIES SKILLED WOOD PATTERNMAKER ON AUTOMOTIVE, MACHINERY AND EXPERIMENTAL WORK. AGE 37. NOW AVAILABLE. ADDRESS BOX 710, THE FOUNDRY, CLEVELAND.

FOREMAN OR SUPERINTENDENT

of stove foundry. Middle age and able. 10 years experience with one of the best and largest stove foundries in the country. Good references. Address Box 707, THE FOUNDRY, Cleveland.

SUPERINTENDENT—METALLURGIST

Practical foundryman, M. I. T. Graduate. Guarantee production of quality castings to rigid specifications at low cost. Fifteen years' experience, cupola and electric, plain, alloy, high-test cast iron, and nonferrous castings. Address Box 683, THE FOUNDRY, Cleveland.

PRACTICAL GRAY IRON MAN

Technically trained, age 30. 10 years experience jobbing and production shops as foreman and assistant superintendent, desires position with future. East preferred. Address Box 339, THE FOUNDRY, Cleveland.

TEACHER

Apprentice supervising or foundry teaching position wanted. Have eight years teaching and seven operating experience. Address Box 688, THE FOUNDRY, Cleveland.

EXPERIENCED FOUNDRY FOREMAN

well versed in foundry practice and all kinds of castings, desires position. Can handle any size casting. Mix by analysis. A1 references. Address Box 720, THE FOUNDRY, Cleveland.

EMPLOYERS who are interested in men for future need are invited to consult the employment records on file with THE FOUNDRY. It is suggested that the position wanted ads be noted and that we be requested to supply detailed information about these men. We have complete records available at your request. This data is supplied in strictest confidence and with permission in the spirit of cooperation in which this offer is made.

What are your needs for OUTSTANDING MEN in these and other departments?

Foremen	**Superintendents**
Molders	**Metallurgists**
Salesmen	**Patternmakers**
Managers	**Mechanics**
Estimators	**Melters**
Core Room	**Cleaning Room**

Address THE FOUNDRY
Classified Advertising Department
Cleveland, Ohio

MANAGER OR SUPERINTENDENT

25 years practical and technical foundry experience. High test, brass, alloy iron. Specialized on high grade castings. Thoroughly trained modern foundry practice. Qualified to direct an organization of any size and assume entire responsibility for the operation of your foundries. Address Box 696, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR GENERAL FOREMAN of nonferrous foundry. Thoroughly practical in all branches, melting, molding, coremaking, jobbing and production work. Castings light and heavy, especially pressure and marine castings. Valves, plumbing goods, etc. Good executive. Highest references furnished. Address Box 739, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRY SUPERINTENDENT

Practical man 25 years in gray iron, semi-steel and alloyed iron. Take complete responsibility metallurgical work, estimating and production. Experienced mass production on light work, castings up to 85 tons; tractors, electrical work, generators, pumps, compressors, diesel and blast furnace gas engines, turbines, machine tool, general machinery. Can produce high grade castings at low cost. Good organizer. Age 44. Address Box 588, THE FOUNDRY, Cleveland.

Positions Wanted

FOUNDRY METALLURGIST

Experienced in gray iron, steel and alloys desires connection. Accurate analyst and competent engineer. Any locality and immediately available. Salary open. Address Box 612, THE FOUNDRY, Cleveland.

IRON MOLDER

Good mechanic on green sand, dry sand or strickle molding, eighteen years experience on machine tools and marine castings, light or heavy, capable or taking charge. Go anywhere. Address Box 737, THE FOUNDRY, Cleveland.

BRASS FOUNDRY FOREMAN

Desires position with reliable organization. 20 years practical experience on chandeliers, castings, architectural and ornamental brass, bronze, aluminum and nickel, silver, steam valves, jobbing and production. Address Box 677, THE FOUNDRY, Cleveland.

PRODUCTION MANAGER

15 years experience in steel and gray iron. 37 years old. Address Box 728, THE FOUNDRY, Cleveland.

GRAY IRON SUPERINTENDENT

23 years experience light to medium jobbing and production. Specialized in all types furnace work. Know molding, jolt machines, sandslingers. Technical and practical training. All-around man. Capable, efficient, reliable. Interview requested. Address Box 679, THE FOUNDRY, Cleveland.

GENERAL FOREMAN OR SUPERINTENDENT

29 years experience on general jobbing and production. Best of references. Address Box 740, THE FOUNDRY, Cleveland.

QUALITY IN YOUR MALLEABLE IRON

You want it. I produce it. My experience and special knowledge will save money for you. Large responsibility solicited. Metallurgy and supervision. Grafton M. Thrasher, 752 Robinson St., Elmira, N. Y.

PRODUCTION FOREMAN

Twenty-nine years experience producing quality castings. Specialize in cleaning molding trouble, reducing costs, installing premium systems. Open shop. Address Box 690, THE FOUNDRY, Cleveland.

FOUNDRY AND SALES ENGINEER

Experienced executive. College and technical school graduate. Steel mill, foundry and sales experience, seeks connection in production or sales departments. Good personality. Wide acquaintance. Address Box 733, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN

Experienced as superintendent or foreman, gray iron, semi-steel and alloyed iron castings; light to heavy. Jobbing or production. Mix by analysis. Age 40. Address Box 738, THE FOUNDRY, Cleveland.

ANNEALING AND FINISHING EXPERT. 12 years experience charge of annealing department. Can anneal with powdered coal, oil and hand fired oven. All types of castings. Know manufacture malleable iron. Age 35. Married. Best references. Address Box 725, THE FOUNDRY, Cleveland.

HIGH GRADE SUPERINTENDENT

Stoves and furnaces or production foundry available. Twenty years experience with the best concerns in the industry. 39 years old. Address Box 692, THE FOUNDRY, Cleveland.

METALLURGICAL-CHEMIST

Technical education. Experience covers electric cast iron, continuous permanent molding, heat treatment, physical testing, electro-plating, finishes, control for steel and cast iron and general miscellaneous analysis. Would like position with future as assistant to manager. References. Address Box 647, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN

Practical man. 20 years experience production, jobbing, continuous molding and melting, coreblowers, sand control for sandslingers and molding machines. Mix by analysis. Address Box 590, THE FOUNDRY, Cleveland.